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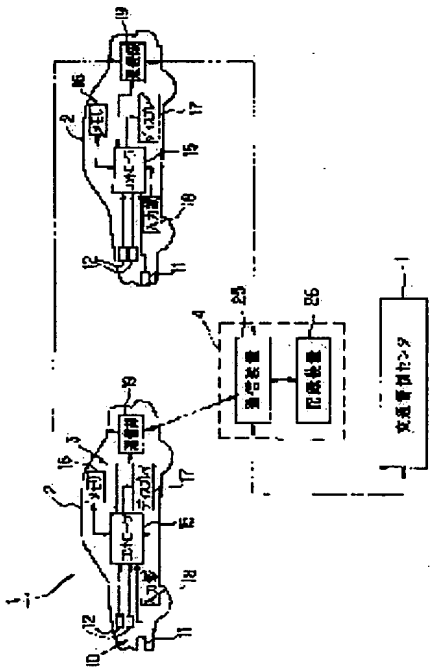
(54) INTER-VEHICLE COMMUNICATION SYSTEM

(57)Abstract:
PROBLEM TO BE SOLVED: To enable all vehicles to previously recognize the generation of traffic states/abnormal events of a road on which infrastructure facilities of a high cost are not installed.
SOLUTION: In an inter-vehicle communication system 1 capable of communicating information among plural vehicles 2 traveling on a road on which infrastructure equipment having sensors and a computer for control and communication processing is not installed, each vehicle 2 is provided with a drive aiding camera 10 (11, 12), mounted on the vehicle 2 itself as drive aid, for photographing images around the vehicle 2 itself and a controller 15 and a communication part 19 for executing processing for detecting traveling related information including at least one of traffic conditions around the vehicle 2 itself and an abnormal event on the basis of the photographed peripheral images and processing for wirelessly transmitting the detected traveling related information to other vehicles.



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CLAIMS

[Claim(s)]
[Claim 1] It is the car-to-car communication system which can communicate information among two or more cars which run a path on the street. Said each car An image photography means to be carried in a self-car as an object for operation exchange, and to photo the image around the self-car concerned, A detection means to detect transit related information including either [at least] the traffic situation of the perimeter of a self-car, or the abnormality events based on the photoed perimeter image, The car-to-car communication system characterized by having a wireless transmitting means to transmit on radio the transit related information detected by this detection means to the other car.
[Claim 2] Said each car is a car-to-car communication system according to claim 1 characterized by having a receiving means to receive the transit related information transmitted from the other car to a self-car, and a display means to display the received transit related information.
[Claim 3] Said wireless transmitting means is a car-to-car communication system according to claim 2 characterized by having a means to transmit said transit related information directly to the car of one [at least] of these when either [at least] a consecutiveness car or the opposite cars exist within limits [a self-car] which can be radiocommunicated.
[Claim 4] Said wireless transmitting means is a car-to-car communication system according to claim 2 characterized by having a means to transmit said transit related information to all the cars that exist within limits [a self-car] which can be radiocommunicated directly.
[Claim 5] It is the car-to-car communication system according to claim 2 which the receiving means of two or more of said cars receives the transit related information concerned when said transit related information has been transmitted from the precedence car by the side of the travelling direction front of a self-car when said two or more cars separate the necessary distance between two cars and have been located in a line in said path on the street, and is characterized by to have a means transmit directly to the car which follows the transit related information which received at a self-car.
[Claim 6] Said wireless transmitting means is a car-to-car communication system according to claim 2 characterized by having a means to transmit said transit related information to the opposite car on the opposite lane which passes to a self-car.
[Claim 7] Said object for transit related information record which said wireless transmitting means vacated predetermined spacing near said road, and was installed possible [a communication link] mutually, and two or more record communication devices for a communication link, A decision means to judge whether the other car exists within limits [said self-car] which can be radiocommunicated, It has a transmitting means to transmit said transit related information to the record communication device located within limits [said self-car] which can be radiocommunicated as a result of decision of this decision means in case the other car does not exist. A record means to record the transit related information to which said record communication device has been transmitted, The 1st transmitting means which transmits the recorded transit related information to other adjoining record communication devices, A receiving means to receive the transit related information transmitted from the other record communication device, As opposed to the other car which is running near the self-record communication device in order to go to said transit related information detection point following said transit related information detection car having had the 2nd transmitting means which transmits the transit related information received by said receiving means -- the car-to-car communication system according to claim 2 characterized by things.
[Claim 8] Said two or more communication devices for a transit related information communication link which said wireless transmitting means vacated predetermined spacing near said road, and were installed, The information management equipment for said transit related information management connected with this communication device possible [an information communication link], A decision means to judge whether the other car exists within limits [said self-car] which can be radiocommunicated, It has a means to transmit said transit related information to the communication device located within limits [said self-car] which can be radiocommunicated as a result of decision of this decision means in case the other car does not exist. Said

communication device It has the 1st transmitting means which transmits the transit related information transmitted by said transmitting means to said information management equipment. Said information management equipment It has a means to transmit the transmitted transit related information to other communication devices around the communication device of a transmitting agency. A communication device besides the above As opposed to the other car which is running near [concerned] the other communication devices in order to go to said transit related information detection point following said transit related information detection car having had the 2nd transmitting means which transmits the transit related information transmitted from said information management equipment -- the car-to-car communication system according to claim 2 characterized by things.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] It is related with the car-to-car communication system which can communicate directly and indirectly the information relevant to transit of each car concerned in between the cars (car-to-car) which run a path on the street.
[0002]
[Description of the Prior Art] The need of road traffic increasing rapidly according to social development, and raising the safety of road traffic is the big technical problem which must be solved towards the future from the present.
[0003] Based on such a background, the shift to ITS (Intelligent Transport System; intelligent transport system) is wholeheartedly advanced in recent years.
[0004] In order to realize such ITS, the information (transit related information) relevant to transit of the car which includes the event which causes abnormalities in collection and car transit of delay etc. of a traffic situation is detected at an early stage, and it is very important to feed back detection information to the driver of each car.
[0005] It is required in the sensor containing image-processing sensors, such as the light camera (for example, a CCD camera) which vacated predetermined spacing for the road side of a road including a crossing etc., and were installed in it as a facility of the infrastructure system which performs the above-mentioned traffic situation collection and abnormality event detection, and the control and the computer for communications processing which perform the processing which is prepared one set at a time according to each sensor, and transmits the control and the detection data about detection processing of the sensor to a traffic-control pin center,large.
[0006] What used the display beforehand carried in the car as some car-navigation systems as a facility of the mounted system which, on the other hand, carries out the monitor of the information fed back from the traffic control pin center,large is common.
[0007]
[Problem(s) to be Solved by the Invention] As mentioned above, in order to perform traffic situation collection and abnormality event detection Since one the control and the computer for communications processing per each sensor are required, In the infrastructure system facility (a sensor, and control and the computer for communications processing) with which it is required that the large detection range should be taken especially The amount of information to process increases, and since there is an inclination for the capacity required of control and the computer for communications processing in proportion to the increment in amount of information to also become high, the cost of the infrastructure system facility which contains one sensor as a result also becomes high.
[0008] That is, it is not realistic on the relation between the cost of each infrastructure system facility [itself] mentioned above, and installation cost, and although it is the ideal of ITS to install the facility (a detector, and control and the computer for communications processing) of an infrastructure system mentioned above on all roads, even if it installs the above-mentioned infrastructure system facility, a dead time becomes long, and since it is inefficient-like, it installs in a road and a crossing with much traffic at a road and a crossing with still less traffic.
[0009] Therefore, there was little traffic and it was difficult to perform traffic situation collection and abnormality event detection at the road and the crossing in which the infrastructure system facility containing the above-mentioned sensor, and control and the computer for communications processing is not installed.
[0010] Consequently, even if risk situations, such as the occurrence of accident, traffic congestion, and falling stone, a landslide, had occurred at the road and the crossing in which the above-mentioned infrastructure system facility is not installed, the car, the consecutiveness car, and the opposite car passing through that location have not recognized the above-mentioned accident, traffic congestion, risk situation generating, etc. in advance, but checked the improvement in safety of road traffic, and were worsening the operational efficiency of

road traffic.
[0011] It sets it as the purpose that this invention offers the car-to-car communication system with which all the cars passing through the above-mentioned road and crossing can recognize in advance generating of the traffic situation produced on the road and the crossing in which the infrastructure system facility of high cost which was made in view of the situation mentioned above, and contains a sensor, and control and the computer for communications processing is not installed, and an abnormality event.
[0012]
[Means for Solving the Problem] The researches and developments which support operation of a driver and raise the safety of road traffic are furthered by carrying the cameras for operation exchange the object for obstruction detection path on the street, the object for lane detection, for collision prevention, etc. [a CCD camera (TV camera) etc.] in each car as a facility of a mounted system in recent years.
[0013] Then, this invention person etc. devised the invention in this application paying attention to the above-mentioned camera for operation exchange being carried in each car.
[0014] According to invention for attaining the purpose mentioned above, it is the car-to-car communication system which can communicate information among two or more cars which run a path on the street. Namely, said each car An image photography means to be carried in a self-car as an object for operation exchange, and to photo the image around the self-car concerned, Based on the photoed perimeter image, it has a detection means to detect transit related information including either [at least] the traffic situation of the perimeter of a self-car, or the abnormality events, and a wireless transmitting means to transmit on radio the transit related information detected by this detection means to the other car.
[0015] Said each car is equipped with a receiving means to receive the transit related information transmitted from the other car to a self-car, and a display means to display the received transit related information, in this invention.
[0016] In this invention, said wireless transmitting means has a means to transmit said transit related information directly to the car of one [at least] of these, in case either [at least] a consecutiveness car or the opposite cars exist within limits [a self-car] which can be radiocommunicated.
[0017] In this invention, said wireless transmitting means has a means to transmit said transit related information to all the cars that exist within limits [a self-car] which can be radiocommunicated directly.
[0018] In this invention, when said two or more cars separate the necessary distance between two cars and are located in a line in said path on the street, the receiving means of two or more of said cars is equipped with a means to transmit directly to the car which receives the transit related information concerned and follows the transit related information which received at a self-car, when said transit related information has been transmitted from the precedence car by the side of the travelling direction front of a self-car.
[0019] In this invention, said wireless transmitting means has a means to transmit said transit related information to the opposite car on the opposite lane which passes to a self-car.
[0020] Said object for transit related information record which said wireless transmitting means vacated predetermined spacing near said road, and was mutually installed possible [a communication link] in this invention, and two or more record communication devices for a communication link, A decision means to judge whether the other car exists within limits [said self-car] which can be radiocommunicated, It has a transmitting means to transmit said transit related information to the record communication device located within limits [said self-car] which can be radiocommunicated as a result of decision of this decision means in case the other car does not exist. A record means to record the transit related information to which said record communication device has been transmitted, The 1st transmitting means which transmits the recorded transit related information to other adjoining record communication devices, A receiving means to receive the transit related information transmitted from the other record communication device, In order to go to said transit related information detection point following said transit related information detection car, it has the 2nd transmitting means which transmits the transit related information received by said receiving means to the other car which is running near the self-record communication device.
[0021] Said two or more communication devices for a transit related information communication link which said wireless transmitting means vacated predetermined spacing near said road, and were installed in this invention, The information management equipment for said transit related information management connected with this communication device possible [an information communication link], A decision means to judge whether the other car exists within limits [said self-car] which can be radiocommunicated, It has a means to transmit said transit related information to the communication device located within limits [said self-car] which can be radiocommunicated as a result of decision of this decision means in case the other car does not exist. Said communication device It has the 1st transmitting means which transmits the transit related information transmitted by said transmitting means to said information management equipment. Said information management equipment It has a means to transmit the transmitted transit related information to other communication devices around the communication device of a transmitting agency. A communication device

besides the above In order to go to said transit related information detection point following said transit related information detection car, it has the 2nd transmitting means which transmits the transit related information transmitted from said information management equipment to the other car which is running near [concerned] the other communication devices.
[0022]
[Embodiment of the Invention] The gestalt of operation of this invention is explained with reference to an accompanying drawing.
[0023] Drawing 1 is the block diagram showing the outline configuration of the car-to-car communication system 1 concerning this operation form.
[0024] According to drawing 1 , the car-to-car communication system 1 is equipped with the communication link record unit 4 which has the function and information communication function which record the information transmitted from the car 2 on the occasion of the car-to-car communication unit 3 for being carried in each car 2 and performing directly and indirectly the communication link between cars (car-to-car), and the indirect communication link between cars.
[0025] In this operation gestalt, the communication link record unit 4 has little traffic, vacates predetermined spacing for the road side of the road in which the infrastructure system facility containing a sensor, and control and the computer for communications processing is not installed, and a crossing, and is installed in it.
[0026] The car-to-car communication unit 3 is equipped with the cameras 10 for operation exchange the object for obstruction detection path on the street, the object for lane detection, for collision prevention, etc. In this operation gestalt, as a camera 10 for operation exchange, as shown in drawing 2 The camera 11 for forward cardiac failure theory object detection of each car 2 is attached in the car-body front side (for example, number plate upper part) of a self-car. Further as a camera 10 for operation exchange The camera 12 for lateral obstacle detection for detecting the obstruction by the side of the method of both sides of a self-car is attached in the method side of both sides of the car body of each car 2 (for example, right-and-left both sides ahead of a car body).
[0027] The camera 11 for forward cardiac failure theory object detection (it is hereafter written as a front camera) photos the image by the side of the self-car front, and the camera 12 for lateral obstacle detection (it is hereafter written as a side camera) photos the image by the side of the self-car side.
[0028] Moreover, the car-to-car communication unit 3 is equipped with the controller 15 for carrying out generalization control of the whole unit, the memory 16 for memorizing the processing program of this controller 15, and data required for processing, and the display 17 for image display.
[0029] The controller 15 of the car-to-car communication unit 3 The function which controls photography processing of the front camera 11 and the side camera 12, the front image photoed with the front camera 11, A function and the side image photoed with the side camera 12 -- being based -- for example, the difference in the brightness of each pixel value, or a color -- the front -- a service road -- a front side obstruction including a way flat-surface top and the obstruction by the side of the side are detected automatically -- A function the front image and side image which were photoed -- being based -- for example, difference -- it detects automatically whether delay has occurred by processing, pattern-matching processing, etc. into a front path on the street and the lanes (opposite lane etc.) of the side -- It has alternation or the function which is put in order and displayed on a display 17 for the front image and side image which memorize the front image and side image which were photoed in memory 16 and which were functioned and photoed.
[0030] That is, a controller 15 can detect the information (transit related information) relevant to transit of the self-car and the other car including traffic situations in either [at least] the front or the sides, such as abnormality events, such as existence of an obstruction, and delay, based on the image photoed by either [at least] the front camera 11 or the side cameras 12.
[0031] And it connected with the controller 15 and the car-to-car communication unit 3 is equipped with the input section 18 which can input the command of the information transmitting command showing generating of a traffic situation and an abnormality event, the image transmitting command showing generating of the traffic situation and an abnormality event, etc. by the driver in the self-car 2, or actuation of a fellow passenger to the controller 15.
[0032] Furthermore, the car-to-car communication unit 3 is equipped with the communications department 19 which can communicate information with the radio system by the electric wave of a millimeter wave band.
[0033] And the controller 15 and the communications department 19 of the car-to-car communication unit 3 of this operation gestalt the other car (a consecutiveness car --) located in the range (for example, the number of radii range to 10 meters) which becomes settled beforehand to a self-car location, and which can be radiocommunicated The function which communicates information on radio between a front car, an opposite car, etc., And it has the function to send an information transmitting command to the communication link record unit 4 arranged in the location which can be radiocommunicated to the function to transmit the information on a photography image etc. to the communication link record unit 4 located within limits which can be

radiocommunicated to a self-car location, and a self-car location etc.
[0034] On the other hand, two or more communication link record units 4 (communication device 25 mentioned later) which vacate predetermined spacing for the road side of a road and a crossing, and are installed in it are connected by the cable 24 possible [the communication link to mutual] for unit 4 adjacent the very thing (communication device 25 mentioned later).
[0035] And the communication link record unit 4 is equipped with the communication device 25 which performs the information communications processing between cars 2, and the information communications processing between the traffic control pin center,larges T, and the recording device 26 which records the information on the photography image which was transmitted from the car 2 and received through the communication device 25.
[0036] Next, the actuation by the whole car-to-car communication system 1 of this operation gestalt is explained.
[0037] The actuation by the whole car-to-car communication system 1 of this operation gestalt does not have the other cars (an opposite car, consecutiveness car, etc.) in the perimeter of (1) self-car, and when the direct communication between cars is difficult, since the other cars (an opposite car, consecutiveness car, etc.) exist in the perimeter of (2) self-cars, and it can divide roughly when the direct communication between cars is possible, the two above-mentioned cases are explained hereafter, respectively.
[0038] (1) As it is shown in drawing 3 when direct communication is difficult for example, the infrastructure system facility containing the sensor, and the control and the computer for communications processing which certain car 2a mentioned above is not installed. the communication link record unit 4 (four a1, four a2) -- for example, crossings calcium1 and calcium2 and ... it shall run during the crossings C1 and C2 on the road R installed in **, and neither a consecutiveness vehicle nor an oncoming car shall run in the perimeter of self-car 2a
[0039] And in this operation gestalt, falling stone should occur as an abnormality event and Obstruction (falling stone) S should be put on the path on the street ahead of car 2a. In addition, since there is little traffic, the distance between a crossing C1 and C2 is long, and the distance of crossings C1 and C2 and falling stone S is also long, and a driver is taken as the thing in which the cognition of falling stone S is impossible from crossings C1 and C2.
[0040] At this time, the controller 15 of car 2a detects automatically the falling stone S which is an obstruction by the above-mentioned obstruction detection processing based on the front image (displayed on the display 17) photoed with the front camera 11 (drawing 4 , step S1).
[0041] Subsequently, the controller 15 of car 2a transmits the signal (signal for car recognition) for recognizing the other car on radio through the communications department 19 to the perimeter of self-car 2a, is information ability ready for receiving, and also it judges whether a car exists or not (step S2).
[0042] Since the other cars (an opposite car, consecutiveness car, etc.) in which an information communication link is possible do not exist in the perimeter of self-car 2a by wireless in the current transit location (near falling-stone S) of self-car 2a as mentioned above, Decision of step S2 serves as NO. The controller 15 of car 2a It judges whether the signal (signal for unit recognition) for recognizing the communication link record unit 4 on radio through the communications department 19 to the perimeter of self-car 2a is transmitted, and the communication link record unit 4 in which information reception is possible exists (step S3).
[0043] In the current transit location (near falling-stone S) of self-car 2a, since the communication link record unit in which an information communication link is possible does not exist in the perimeter by wireless, decision of step S3 serves as NO, and a controller 15 performs decision processing of steps S2-S3 repeatedly according to advance (transit) of a car 2.
[0044] If transit of car 2a progresses, self-car 2a approaches a crossing C2 on the other hand and the communication link record unit four a2 is located in the radio intelligence grasp of self-car 2a, the reply signal over the above-mentioned signal for recognition will be transmitted to car 2a from the communication device 25 of the communication link unit four a2.
[0045] If a reply signal is transmitted from the communication link record unit four a2 and it is received through the communications department 19, decision of step S3 of the controller 15 of self-car 2a serves as YES, and a controller 15 will transmit the falling-stone S detection information containing the image with which the falling stone S photoed by processing of step S1 was displayed to the communication link record unit four a2 located within limits which can be radiocommunicated (refer to step S4 and drawing 5).
[0046] The communication device 25 of the communication link record unit four a2 transmits the falling-stone S detection information to the communication device 25 of an adjacent communication link record unit (for example, communication link record unit four a1), and transmits it to the traffic control pin center,large T if needed while it records the transmitted falling-stone S detection information on a recording device 26 (step S5).

[0047] The communication device 25 of the communication link record unit four a1 records the transmitted falling-stone S detection information on a recording device 26 (step S6).

[0048] Then, as shown in drawing 6 , suppose that consecutiveness car 2b ran Road R top toward the crossing C1, and oncoming car both 2c has run toward a crossing C2 in the opposite lane.
[0049] At this time, the communication link record unit four a1 and the communication device 25 of four a2 which were installed in the road side of crossings C1 and C2, respectively have transmitted the signal (signal for car recognition) for recognizing a car on radio to the self-unit four a1 and the perimeter of four a2, respectively, and judge whether the car has run or not (step S7).
[0050] Here, when the car in which an information communication link by wireless is possible has not been running the communication link record unit four a1 and around four a2, decision of step S7 serves as NO, and a communication device 15 repeats step S7 decision processing, and performs it.
[0051] If the communication link record unit four a1 is located in the range of consecutiveness car 2b which can be radiocommunicated and the communication link record unit four a2 is now located in the range of oncoming car both 2c which can be radiocommunicated, the reply signal over the above-mentioned signal for car recognition will be transmitted to the communication link record unit four a1 and four a2 through the communications department 19, respectively from the controller 15 of consecutiveness car 2b and oncoming car both 2c.
[0052] If a reply signal is transmitted from car 2b and 2c, decision processing of step S7 of a communication device 25 serves as YES, and the communication link record unit four a1 and the communication device 25 of four a2 will read the falling-stone S detection information recorded on the recording device 26, respectively, and will transmit it to corresponding consecutiveness car 2b and oncoming car both 2c, respectively (step S8).
[0053] The controller 15 of consecutiveness car 2b and oncoming car both 2c receives the transmitted falling-stone S detection information through the communications department 19, and displays the received falling-stone S detection information on a display 17, respectively (step S9).
[0054] That is, it means that it is indirectly transmitted to the other car (consecutiveness car 2b and oncoming car both 2c) through the communication link record unit four a1 installed in the road side of Road R, and four a2, and the falling-stone S detection information acquired by car 2a was displayed on the display 17.
[0055] Consequently, by seeing the falling-stone S detection information displayed on the display 17 in self-car 2b and 2c, the driver which operates car 2b and 2c can recognize in advance that falling stone S is ahead [of crossings C1 and C2 / travelling direction], and can bypass right-turn and the road R which turns left (refer to drawing 6 and a two-dot chain line), and includes falling stone S for crossings C1 and C2.
[0056] (2) When direct communication is possible, consider the case where the communication link record unit four a2 is not installed in the crossing C2, in above-shown drawing 3 .
[0057] At this time, the controller 15 of car 2a detects falling stone S by processing of step S1, and car 2a which runs during crossings C1 and C2 judges whether to the perimeter of self-car 2a, it is information ability ready for receiving, and also a car or a communication link record unit exists in step S2 and step S3.
[0058] In the current transit location (near falling-stone S) of self-car 2a, since the other car in which an information communication link is possible does not exist in the perimeter by wireless, each decision of step S2 and step S3 serves as NO, and a controller 15 performs decision processing of steps S2-S3 repeatedly according to advance (transit) of a car 2.
[0059] And when car 2a crosses a crossing C2, 2d of opposite cars runs the opposite lane to the slow lane on Road R, and it is going to the crossing C2, and suppose that the oncoming car both 2e entered in the radio intelligence grasp of car 2a.
[0060] At this time, the result of decision of step S2 of the controller 15 of car 2a serves as YES, and a controller 15 transmits the falling-stone S detection information containing the falling-stone S display image photoed by processing of step S1 to 2d of opposite cars through the communications department 19 (step S10).
[0061] The controller 15 of 2d of opposite cars receives the transmitted falling-stone S detection information that it came, through the communications department 19, and displays the received falling-stone S detection information on a display 17 (step S11).
[0062] That is, it means that it is transmitted to 2d (opposite car) of direct other cars, and the falling-stone S detection information acquired by car 2a was displayed on the display 17.
[0063] Consequently, by seeing the falling-stone S detection information displayed on the display 17 of 2d of self-cars, the driver which operates 2d of opposite cars can recognize in advance that falling stone S is ahead [of a crossing C2 / travelling direction], and can bypass right-turn and the road R which turns left (drawing 7 ; refer to two-dot chain line), and includes falling stone S for a crossing C2.
[0064] In processing of steps S2 and S3 mentioned above in addition, the controller 15 of car 2a Although it judges automatically that the other car or a communication link record unit exists within limits with information reception possible in which, i.e., within the limits which can be radiocommunicated, by transmitting the other car or the signal for communication link record unit recognition to the perimeter of self-car 2a, and receiving a reply signal This invention is not limited to this, and, as for other car ****, a driver detects and judges by vision that a communication link record unit exists by the manual within limits which can be radiocommunicated. The falling-

stone S detection information transmitting command to the other car or the communication link record unit which operates the input section 18 and is located within limits which can be radiocommunicated can also be transmitted to a controller 15. At this time, a controller 15 transmits falling-stone S detection information to the other car or the communication link record unit located within limits which can be radiocommunicated like step S4 or step S10 according to the transmitted falling-stone S detection information transmitting command.
[0065] Moreover, in processing of step S7 mentioned above, although it judges automatically that car 2b and 2c have run by transmitting the signal for car recognition and receiving a reply signal within limits which can radiocommunicate in the communication link record unit four a1 and the communication device 25 of four a2, this invention is not limited to this.
[0066] For example, instead of step S7, the driver of car 2b and 2c may detect and judge by vision that the communication link record unit four a1 and four a2 exist within limits [a self-car] which can be radiocommunicated by the manual, and may transmit an information Request to Send to the communication link record unit four a1 which operates the input section 18 and is located within limits which can be radiocommunicated, and four a2.
[0067] At this time, decision of step S7 will serve as YES, and the communication link record unit four a1 and the communication device 25 of four a2 will perform falling-stone S detection information transmitting processing of step S7, if the above-mentioned information Request to Send is transmitted.
[0068] If one car detects generating of the abnormality event (falling stone) produced on the road and the crossing in which the infrastructure system facility containing a sensor, and control and the computer for communications processing of high cost is not installed with the camera for operation exchange according to this operation gestalt as stated above Indirect through the communication link record unit installed in the road side of a road in this detected abnormality event generating information Since it can transmit in advance to the other cars (a consecutiveness car, opposite car, etc.) which go to the above-mentioned abnormality event generating point next directly, or the other car Even if the infrastructure system facility containing the above-mentioned sensor, and control and the computer for communications processing of high cost is not installed in the road, abnormality event generating information can be acquired in advance than the time of abnormality event generating point attainment.
[0069] Therefore, since the other cars, such as a consecutiveness car and an opposite car, can run appropriately corresponding to the above-mentioned abnormality event generating of the detour transit mentioned above, for example, they can raise the safety and operational efficiency of road traffic.
[0070] According to this operation gestalt, moreover, each communication link record unit four a1 and the communication device 25 of four a2 Since abnormality event generating information, such as falling-stone S detection information transmitted from car 2a, can be transmitted to the traffic control pin center,large T, the traffic control pin center,large T Generating of the abnormality event produced on the road and the crossing in which the infrastructure system facility containing the above-mentioned sensor, and the control and the computer for communications processing which had taken time amount grasp and to recognize conventionally of high cost is not installed Since it can grasp and recognize simply and quickly, treatment corresponding to the generated abnormality event can be performed quickly, and the safety and operational efficiency of road traffic can be raised further.
[0071] In addition, with this operation gestalt, although the abnormality event was considered as falling stone, artificial outbreak events, such as sudden natural phenomena, such as a landslide, and high tide, a boulder flow, and a traffic accident, are also included that it cannot be overemphasized that this invention is not limited to this.
[0072] And in this operation gestalt, although generating of an abnormality event (falling stone) was detected, it is also possible for this invention not to be limited to this and to detect traffic situations, such as traffic congestion.
[0073] For example, as shown in drawing 8 , it is running the road RA top in which the infrastructure system facility containing the sensor, and the control and the computer for communications processing which 2h of a certain cars mentioned above is not installed toward a crossing C3. The traffic situation on the road RA (the signal of a crossing C3 is yellow and those with oncoming car both 2i which turn to the right) is interrupted by large-sized forward vehicle both 2j, and presupposes that it is a dead angle (outside of a visual field) from the driver of 2h of self-cars.
[0074] even in this case, processing of steps S1, S2, and S10 of drawing 4 , and step S11 -- being the same (falling-stone S detection information changing to traffic situation detection information) -- The traffic situation detection information containing the front image photoed with the camera 10 (front camera 11) for operation exchange of forward vehicle both 2j, i.e., the image showing the traffic situation by the side of the self-car front It is transmitted to 2h of consecutiveness cars located within limits [forward vehicle both 2j] which can be radiocommunicated by processing of a controller 15 (step S1, step S2, and step S10 reference), and is displayed on the display 17 in 2h of consecutiveness cars.

[0075] The driver of 2h of consecutiveness cars consequently, by seeing the traffic situation detection information displayed on the display 17 Since it can recognize in advance that the traffic situation besides a visual field, i.e., the signal of a crossing C3, has that it is yellow and opposite right-turn car 2i, It can have allowances also in a rapid signal change, and it can be coped with, and generating of the collision with opposite right-turn car 2i etc. can be avoided, and the safety and operational efficiency of road traffic can be raised.
[0076] And although the operation gestalt mentioned above explained the case where the other cars, such as a consecutiveness vehicle and an oncoming car, were one set at a time, respectively, this invention is not limited to this.
[0077] Namely, as shown in drawing 9 (A) [when 3 and ... are running 2m cars / of two or more consecutiveness cars / 2 or 2m / 3, ..., 2n of consecutiveness cars / 2 or 2n following 1, respectively 2m 1 and 2n of its opposite car of cars which detected the traffic situation and the abnormality event with the camera 10 for operation exchange carried in the self-car] 2m 1 and 2m of consecutiveness cars which received 2 the traffic situation /n of abnormality event detection information from 1 of detection cars 2 and 2n2 It is [2m of consecutiveness cars of a self-car] also possible 3 and to transmit 2 the traffic situation /n of abnormality event detection information to 3, and to transmit a traffic situation / abnormality event detection information to a sequential consecutiveness car hereafter. Consequently, all the cars that follow can acquire a traffic situation / abnormality event detection information in advance, and can contribute to the improvement in safety of road traffic, and improvement in operational efficiency.
[0078] moreover, the car (a forward vehicle -- both -- 2sk-2, 2sk-1, consecutiveness car 2sk+1, and an oncoming car -- both -- 2tk-1 -- 2 tk) of plurality [within the limits / of car 2sk which detected the traffic situation and the abnormality event with the camera 10 for operation exchange carried in the self-car as shown in drawing 9 (B) / radio intelligence ready-for-sending ability] [when 2tk+1 is running] detection car 2sk It is also possible to transmit a traffic situation / abnormality event detection information to all the cars (1 forward vehicle both 2sk(s)- 2, 2sk- 1 and consecutiveness car 2sk+ 1, oncoming car both 2tk(s)- two tk, 2tk+ 1) of the wireless ready-for-sending ability within the limits. Consequently, all the cars that run wireless ready-for-sending ability within the limits of a traffic situation / abnormality event detection car can acquire a traffic situation / abnormality event detection information, and can contribute to the improvement in safety of road traffic, and improvement in operational efficiency.
[0079] Furthermore, as shown in drawing 9 (C), it passes to opposite car 2yk which passes, respectively, 2yk+1, ... and opposite car 2xk, 2xk+1, and ..., and car 2x which detected the traffic situation and the abnormality event with the camera 10 for operation exchange carried in the self-car, and car 2y of the opposite lane can also sometimes transmit a traffic situation / abnormality event detection information. Consequently, all the opposite cars that pass by the traffic situation / abnormality event detection car can acquire a traffic situation / abnormality event detection information in advance, and can contribute it to the improvement in safety of road traffic, and improvement in operational efficiency.
[0080] In addition, in this operation gestalt, as a medium of car-to-car radio, although the electric wave of for example, a millimeter wave band is used, this invention is not limited to this and can also use a different medium from an infrared electric wave.
[0081] Moreover, in this operation gestalt, although the communication link record unit has the recording device and a traffic situation / abnormality event detection information was recorded on this recording device, this invention is not limited to this and may use the communication link unit which has the communication facility between the traffic control pin center,larges T equipped only with the communication device mentioned above as a substitute of the communication link record unit of this operation gestalt (junction function).
[0082] When this communication link unit is used and a traffic situation / abnormality event detection information is transmitted to a traffic control pin center,large from a predetermined car via a certain communication link unit (transmitting agency communication link unit), By transmitting the above-mentioned traffic situation / abnormality event detection information to the communication link unit around a transmitting agency communication link unit (transmission place communication link unit) from a traffic control pin center,large Since the above-mentioned traffic situation / abnormality event detection information can be transmitted from each transmission place communication link unit to the other cars, such as a car which follows the above-mentioned predetermined car, the same effectiveness as this operation gestalt can be acquired.
[0083] Furthermore, in this operation gestalt, as a traffic situation / an abnormality event detection image, although the image of a front camera was used, it is also possible for this invention not to be limited to this and to use the image of a side camera or the image of both cameras.
[0084] And in this operation gestalt, although the camera for obstruction detection was used as a camera for operation exchange, this invention is not limited to this and may use other cameras for operation exchange, such as a camera for lane detection, and a camera for collision prevention.
[0085]
[Effect of the Invention] If one car detects transit related information containing a sensor, and control and the

computer for communications processing, such as abnormality event generating path on the street, a traffic situation, etc. that an infrastructure system facility of high cost is not installed, with the image photography means for operation exchange according to the car-to-car communication system of this invention as stated above Since this detected transit related information can be transmitted to the other cars, such as a consecutiveness car and an opposite car, through a record communication device, a communication device, etc. which were installed near the road indirectly or directly, The other car can obtain transit related information, such as an abnormality event and a traffic situation, in advance, even if the infrastructure system facility containing the above-mentioned sensor, and control and the computer for communications processing of high cost is not installed in the road.

[0086] Therefore, since drivers, such as a consecutiveness car and an opposite car, can make it run a self-car appropriately according to the obtained transit related information, they can raise the safety and operational efficiency of road traffic.

[Translation done.]

TECHNICAL FIELD

[Field of the Invention] It is related with the car-to-car communication system which can communicate directly and indirectly the information relevant to transit of each car concerned in between the cars (car-to-car) which run a path on the street.

[Translation done.]

PRIOR ART

[Description of the Prior Art] The need of road traffic increasing rapidly according to social development, and raising the safety of road traffic is the big technical problem which must be solved towards the future from the present.

[0003] Based on such a background, the shift to ITS (Intelligent Transport System; intelligent transport system) is wholeheartedly advanced in recent years.

[0004] In order to realize such ITS, the information (transit related information) relevant to transit of the car which includes the event which causes abnormalities in collection and car transit of delay etc. of a traffic situation is detected at an early stage, and it is very important to feed back detection information to the driver of each car.

[0005] It is required in the sensor containing image-processing sensors, such as the light camera (for example, a CCD camera) which vacated predetermined spacing for the road side of a road including a crossing etc., and were installed in it as a facility of the infrastructure system which performs the above-mentioned traffic situation collection and abnormality event detection, and the control and the computer for communications processing which perform the processing which is prepared one set at a time according to each sensor, and transmits the control and the detection data about detection processing of the sensor to a traffic-control pin center,large.

[0006] What used the display beforehand carried in the car as some car-navigation systems as a facility of the mounted system which, on the other hand, carries out the monitor of the information fed back from the traffic control pin center,large is common.

[Translation done.]

EFFECT OF THE INVENTION

[Effect of the Invention] If one car detects transit related information containing a sensor, and control and the computer for communications processing, such as abnormality event generating path on the street, a traffic situation, etc. that an infrastructure system facility of high cost is not installed, with the image photography means for operation exchange according to the car-to-car communication system of this invention as stated above Since this detected transit related information can be transmitted to the other cars, such as a consecutiveness car and an opposite car, through a record communication device, a communication device, etc. which were installed near the road indirectly or directly, The other car can obtain transit related information, such as an abnormality event and a traffic situation, in advance, even if the infrastructure system facility containing the above-mentioned sensor, and control and the computer for communications processing of high cost is not installed in the road.
[0086] Therefore, since drivers, such as a consecutiveness car and an opposite car, can make it run a self-car appropriately according to the obtained transit related information, they can raise the safety and operational efficiency of road traffic.

[Translation done.]

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] As mentioned above, in order to perform traffic situation collection and abnormality event detection Since one the control and the computer for communications processing per each sensor are required, In the infrastructure system facility (a sensor, and control and the computer for communications processing) with which it is required that the large detection range should be taken especially The amount of information to process increases, and since there is an inclination for the capacity required of control and the computer for communications processing in proportion to the increment in amount of information to also become high, the cost of the infrastructure system facility which contains one sensor as a result also becomes high.

[0008] That is, it is not realistic on the relation between the cost of each infrastructure system facility [itself] mentioned above, and installation cost, and although it is the ideal of ITS to install the facility (a detector, and control and the computer for communications processing) of an infrastructure system mentioned above on all roads, even if it installs the above-mentioned infrastructure system facility, a dead time becomes long, and since it is inefficient-like, it installs in a road and a crossing with much traffic at a road and a crossing with still less traffic.

[0009] Therefore, there was little traffic and it was difficult to perform traffic situation collection and abnormality event detection at the road and the crossing in which the infrastructure system facility containing the above-mentioned sensor, and control and the computer for communications processing is not installed.

[0010] Consequently, even if risk situations, such as the occurrence of accident, traffic congestion, and falling stone, a landslide, had occurred at the road and the crossing in which the above-mentioned infrastructure system facility is not installed, the car, the consecutiveness car, and the opposite car passing through that location have not recognized the above-mentioned accident, traffic congestion, risk situation generating, etc. in advance, but checked the improvement in safety of road traffic, and were worsening the operational efficiency of road traffic.

[0011] It sets it as the purpose that this invention offers the car-to-car communication system with which all the cars passing through the above-mentioned road and crossing can recognize in advance generating of the traffic situation produced on the road and the crossing in which the infrastructure system facility of high cost which was made in view of the situation mentioned above, and contains a sensor, and control and the computer for communications processing is not installed, and an abnormality event.

[Translation done.]

MEANS

[Means for Solving the Problem] The researches and developments which support operation of a driver and raise the safety of road traffic are furthered by carrying the cameras for operation exchange the object for obstruction detection path on the street, the object for lane detection, for collision prevention, etc. [a CCD camera (TV camera) etc.] in each car as a facility of a mounted system in recent years.
[0013] Then, this invention person etc. devised the invention in this application paying attention to the above-mentioned camera for operation exchange being carried in each car.
[0014] According to invention for attaining the purpose mentioned above, it is the car-to-car communication system which can communicate information among two or more cars which run a path on the street. Namely, said each car An image photography means to be carried in a self-car as an object for operation exchange, and to photo the image around the self-car concerned, Based on the photoed perimeter image, it has a detection means to detect transit related information including either [at least] the traffic situation of the perimeter of a self-car, or the abnormality events, and a wireless transmitting means to transmit on radio the transit related information detected by this detection means to the other car.
[0015] Said each car is equipped with a receiving means to receive the transit related information transmitted from the other car to a self-car, and a display means to display the received transit related information, in this invention.
[0016] In this invention, said wireless transmitting means has a means to transmit said transit related information directly to the car of one [at least] of these, in case either [at least] a consecutiveness car or the opposite cars exist within limits [a self-car] which can be radiocommunicated.
[0017] In this invention, said wireless transmitting means has a means to transmit said transit related information to all the cars that exist within limits [a self-car] which can be radiocommunicated directly.
[0018] In this invention, when said two or more cars separate the necessary distance between two cars and are located in a line in said path on the street, the receiving means of two or more of said cars is equipped with a means to transmit directly to the car which receives the transit related information concerned and follows the transit related information which received at a self-car, when said transit related information has been transmitted from the precedence car by the side of the travelling direction front of a self-car.
[0019] In this invention, said wireless transmitting means has a means to transmit said transit related information to the opposite car on the opposite lane which passes to a self-car.
[0020] Said object for transit related information record which said wireless transmitting means vacated predetermined spacing near said road, and was mutually installed possible [a communication link] in this invention, and two or more record communication devices for a communication link, A decision means to judge whether the other car exists within limits [said self-car] which can be radiocommunicated, It has a transmitting means to transmit said transit related information to the record communication device located within limits [said self-car] which can be radiocommunicated as a result of decision of this decision means in case the other car does not exist. A record means to record the transit related information to which said record communication device has been transmitted, The 1st transmitting means which transmits the recorded transit related information to other adjoining record communication devices, A receiving means to receive the transit related information transmitted from the other record communication device, In order to go to said transit related information detection point following said transit related information detection car, it has the 2nd transmitting means which transmits the transit related information received by said receiving means to the other car which is running near the self-record communication device.
[0021] Said two or more communication devices for a transit related information communication link which said wireless transmitting means vacated predetermined spacing near said road, and were installed in this invention, The information management equipment for said transit related information management connected with this communication device possible [an information communication link], A decision means to judge whether the other car exists within limits [said self-car] which can be radiocommunicated, It has a means to transmit said transit related information to the communication device located within limits [said self-car] which can be radiocommunicated as a result of decision of this decision means in case the other car does not exist. Said

communication device It has the 1st transmitting means which transmits the transit related information transmitted by said transmitting means to said information management equipment. Said information management equipment It has a means to transmit the transmitted transit related information to other communication devices around the communication device of a transmitting agency. A communication device besides the above In order to go to said transit related information detection point following said transit related information detection car, it has the 2nd transmitting means which transmits the transit related information transmitted from said information management equipment to the other car which is running near [concerned] the other communication devices.

[0022]

[Embodiment of the Invention] The gestalt of operation of this invention is explained with reference to an accompanying drawing.

[0023] Drawing 1 is the block diagram showing the outline configuration of the car-to-car communication system 1 concerning this operation form.

[0024] According to drawing 1 , the car-to-car communication system 1 is equipped with the communication link record unit 4 which has the function and information communication function which record the information transmitted from the car 2 on the occasion of the car-to-car communication unit 3 for being carried in each car 2 and performing directly and indirectly the communication link between cars (car-to-car), and the indirect communication link between cars.

[0025] In this operation gestalt, the communication link record unit 4 has little traffic, vacates predetermined spacing for the road side of the road in which the infrastructure system facility containing a sensor, and control and the computer for communications processing is not installed, and a crossing, and is installed in it.

[0026] The car-to-car communication unit 3 is equipped with the cameras 10 for operation exchange the object for obstruction detection path on the street, the object for lane detection, for collision prevention, etc. In this operation gestalt, as a camera 10 for operation exchange, as shown in drawing 2 The camera 11 for forward cardiac failure theory object detection of each car 2 is attached in the car-body front side (for example, number plate upper part) of a self-car. Further as a camera 10 for operation exchange The camera 12 for lateral obstacle detection for detecting the obstruction by the side of the method of both sides of a self-car is attached in the method side of both sides of the car body of each car 2 (for example, right-and-left both sides ahead of a car body).

[0027] The camera 11 for forward cardiac failure theory object detection (it is hereafter written as a front camera) photos the image by the side of the self-car front, and the camera 12 for lateral obstacle detection (it is hereafter written as a side camera) photos the image by the side of the self-car side.

[0028] Moreover, the car-to-car communication unit 3 is equipped with the controller 15 for carrying out generalization control of the whole unit, the memory 16 for memorizing the processing program of this controller 15, and data required for processing, and the display 17 for image display.

[0029] The controller 15 of the car-to-car communication unit 3 The function which controls photography processing of the front camera 11 and the side camera 12, the front image photoed with the front camera 11, A function and the side image photoed with the side camera 12 -- being based -- for example, the difference in the brightness of each pixel value, or a color -- the front -- a service road -- a front side obstruction including a way flat-surface top and the obstruction by the side of the side are detected automatically -- A function the front image and side image which were photoed -- being based -- for example, difference -- it detects automatically whether delay has occurred by processing, pattern-matching processing, etc. into a front path on the street and the lanes (opposite lane etc.) of the side -- It has alternation or the function which is put in order and displayed on a display 17 for the front image and side image which memorize the front image and side image which were photoed in memory 16 and which were functioned and photoed.

[0030] That is, a controller 15 can detect the information (transit related information) relevant to transit of the self-car and the other car including traffic situations in either [at least] the front or the sides, such as abnormality events, such as existence of an obstruction, and delay, based on the image photoed by either [at least] the front camera 11 or the side cameras 12.

[0031] And it connected with the controller 15 and the car-to-car communication unit 3 is equipped with the input section 18 which can input the command of the information transmitting command showing generating of a traffic situation and an abnormality event, the image transmitting command showing generating of the traffic situation and an abnormality event, etc. by the driver in the self-car 2, or actuation of a fellow passenger to the controller 15.

[0032] Furthermore, the car-to-car communication unit 3 is equipped with the communications department 19 which can communicate information with the radio system by the electric wave of a millimeter wave band.

[0033] And the controller 15 and the communications department 19 of the car-to-car communication unit 3 of this operation gestalt the other car (a consecutiveness car --) located in the range (for example, the number of radii range to 10 meters) which becomes settled beforehand to a self-car location, and which can be

radiocommunicated The function which communicates information on radio between a front car, an opposite car, etc., And it has the function to send an information transmitting command to the communication link record unit 4 arranged in the location which can be radiocommunicated to the function to transmit the information on a photography image etc. to the communication link record unit 4 located within limits which can be radiocommunicated to a self-car location, and a self-car location etc.
[0034] On the other hand, two or more communication link record units 4 (communication device 25 mentioned later) which vacate predetermined spacing for the road side of a road and a crossing, and are installed in it are connected by the cable 24 possible [the communication link to mutual] for unit 4 adjacent the very thing (communication device 25 mentioned later).
[0035] And the communication link record unit 4 is equipped with the communication device 25 which performs the information communications processing between cars 2, and the information communications processing between the traffic control pin center,larges T, and the recording device 26 which records the information on the photography image which was transmitted from the car 2 and received through the communication device 25.
[0036] Next, the actuation by the whole car-to-car communication system 1 of this operation gestalt is explained.
[0037] The actuation by the whole car-to-car communication system 1 of this operation gestalt does not have the other cars (an opposite car, consecutiveness car, etc.) in the perimeter of (1) self-car, and when the direct communication between cars is difficult, since the other cars (an opposite car, consecutiveness car, etc.) exist in the perimeter of (2) self-cars, and it can divide roughly when the direct communication between cars is possible, the two above-mentioned cases are explained hereafter, respectively.
[0038] (1) As it is shown in drawing 3 when direct communication is difficult for example, the infrastructure system facility containing the sensor, and the control and the computer for communications processing which certain car 2a mentioned above is not installed. the communication link record unit 4 (four a1, four a2) -- for example, crossings calcium1 and calcium2 and ... it shall run during the crossings C1 and C2 on the road R installed in **, and neither a consecutiveness vehicle nor an oncoming car shall run in the perimeter of self-car 2a
[0039] And in this operation gestalt, falling stone should occur as an abnormality event and Obstruction (falling stone) S should be put on the path on the street ahead of car 2a. In addition, since there is little traffic, the distance between a crossing C1 and C2 is long, and the distance of crossings C1 and C2 and falling stone S is also long, and a driver is taken as the thing in which the cognition of falling stone S is impossible from crossings C1 and C2.
[0040] At this time, the controller 15 of car 2a detects automatically the falling stone S which is an obstruction by the above-mentioned obstruction detection processing based on the front image (displayed on the display 17) photoed with the front camera 11 (drawing 4 , step S1).
[0041] Subsequently, the controller 15 of car 2a transmits the signal (signal for car recognition) for recognizing the other car on radio through the communications department 19 to the perimeter of self-car 2a, is information ability ready for receiving, and also it judges whether a car exists or not (step S2).
[0042] Since the other cars (an opposite car, consecutiveness car, etc.) in which an information communication link is possible do not exist in the perimeter of self-car 2a by wireless in the current transit location (near falling-stone S) of self-car 2a as mentioned above, Decision of step S2 serves as NO. The controller 15 of car 2a It judges whether the signal (signal for unit recognition) for recognizing the communication link record unit 4 on radio through the communications department 19 to the perimeter of self-car 2a is transmitted, and the communication link record unit 4 in which information reception is possible exists (step S3).
[0043] In the current transit location (near falling-stone S) of self-car 2a, since the communication link record unit in which an information communication link is possible does not exist in the perimeter by wireless, decision of step S3 serves as NO, and a controller 15 performs decision processing of steps S2-S3 repeatedly according to advance (transit) of a car 2.
[0044] If transit of car 2a progresses, self-car 2a approaches a crossing C2 on the other hand and the communication link record unit four a2 is located in the radio intelligence grasp of self-car 2a, the reply signal over the above-mentioned signal for recognition will be transmitted to car 2a from the communication device 25 of the communication link unit four a2.
[0045] If a reply signal is transmitted from the communication link record unit four a2 and it is received through the communications department 19, decision of step S3 of the controller 15 of self-car 2a serves as YES, and a controller 15 will transmit the falling-stone S detection information containing the image with which the falling stone S photoed by processing of step S1 was displayed to the communication link record unit four a2 located within limits which can be radiocommunicated (refer to step S4 and drawing 5).
[0046] The communication device 25 of the communication link record unit four a2 transmits the falling-stone S detection information to the communication device 25 of an adjacent communication link record unit (for example, communication link record unit four a1), and transmits it to the traffic control pin center,large T if

needed while it records the transmitted falling-stone S detection information on a recording device 26 (step S5).

[0047] The communication device 25 of the communication link record unit four a1 records the transmitted falling-stone S detection information on a recording device 26 (step S6).
[0048] Then, as shown in drawing 6 , suppose that consecutiveness car 2b ran Road R top toward the crossing C1, and oncoming car both 2c has run toward a crossing C2 in the opposite lane.
[0049] At this time, the communication link record unit four a1 and the communication device 25 of four a2 which were installed in the road side of crossings C1 and C2, respectively have transmitted the signal (signal for car recognition) for recognizing a car on radio to the self-unit four a1 and the perimeter of four a2, respectively, and judge whether the car has run or not (step S7).
[0050] Here, when the car in which an information communication link by wireless is possible has not been running the communication link record unit four a1 and around four a2, decision of step S7 serves as NO, and a communication device 15 repeats step S7 decision processing, and performs it.
[0051] If the communication link record unit four a1 is located in the range of consecutiveness car 2b which can be radiocommunicated and the communication link record unit four a2 is now located in the range of oncoming car both 2c which can be radiocommunicated, the reply signal over the above-mentioned signal for car recognition will be transmitted to the communication link record unit four a1 and four a2 through the communications department 19, respectively from the controller 15 of consecutiveness car 2b and oncoming car both 2c.
[0052] If a reply signal is transmitted from car 2b and 2c, decision processing of step S7 of a communication device 25 serves as YES, and the communication link record unit four a1 and the communication device 25 of four a2 will read the falling-stone S detection information recorded on the recording device 26, respectively, and will transmit it to corresponding consecutiveness car 2b and oncoming car both 2c, respectively (step S8).
[0053] The controller 15 of consecutiveness car 2b and oncoming car both 2c receives the transmitted falling-stone S detection information through the communications department 19, and displays the received falling-stone S detection information on a display 17, respectively (step S9).
[0054] That is, it means that it is indirectly transmitted to the other car (consecutiveness car 2b and oncoming car both 2c) through the communication link record unit four a1 installed in the road side of Road R, and four a2, and the falling-stone S detection information acquired by car 2a was displayed on the display 17.
[0055] Consequently, by seeing the falling-stone S detection information displayed on the display 17 in self-car 2b and 2c, the driver which operates car 2b and 2c can recognize in advance that falling stone S is ahead [of crossings C1 and C2 / travelling direction], and can bypass right-turn and the road R which turns left (refer to drawing 6 and a two-dot chain line), and includes falling stone S for crossings C1 and C2.
[0056] (2) When direct communication is possible, consider the case where the communication link record unit four a2 is not installed in the crossing C2, in above-shown drawing 3 .
[0057] At this time, the controller 15 of car 2a detects falling stone S by processing of step S1, and car 2a which runs during crossings C1 and C2 judges whether to the perimeter of self-car 2a, it is information ability ready for receiving, and also a car or a communication link record unit exists in step S2 and step S3.
[0058] In the current transit location (near falling-stone S) of self-car 2a, since the other car in which an information communication link is possible does not exist in the perimeter by wireless, each decision of step S2 and step S3 serves as NO, and a controller 15 performs decision processing of steps S2-S3 repeatedly according to advance (transit) of a car 2.
[0059] And when car 2a crosses a crossing C2, 2d of opposite cars runs the opposite lane to the slow lane on Road R, and it is going to the crossing C2, and suppose that the oncoming car both 2e entered in the radio intelligence grasp of car 2a.
[0060] At this time, the result of decision of step S2 of the controller 15 of car 2a serves as YES, and a controller 15 transmits the falling-stone S detection information containing the falling-stone S display image photoed by processing of step S1 to 2d of opposite cars through the communications department 19 (step S10).
[0061] The controller 15 of 2d of opposite cars receives the transmitted falling-stone S detection information that it came, through the communications department 19, and displays the received falling-stone S detection information on a display 17 (step S11).
[0062] That is, it means that it is transmitted to 2d (opposite car) of direct other cars, and the falling-stone S detection information acquired by car 2a was displayed on the display 17.
[0063] Consequently, by seeing the falling-stone S detection information displayed on the display 17 of 2d of self-cars, the driver which operates 2d of opposite cars can recognize in advance that falling stone S is ahead [of a crossing C2 / travelling direction], and can bypass right-turn and the road R which turns left (drawing 7 ; refer to two-dot chain line), and includes falling stone S for a crossing C2.
[0064] In processing of steps S2 and S3 mentioned above in addition, the controller 15 of car 2a Although it judges automatically that the other car or a communication link record unit exists within limits with information

reception possible in which, i.e., within the limits which can be radiocommunicated, by transmitting the other car or the signal for communication link record unit recognition to the perimeter of self-car 2a, and receiving a reply signal This invention is not limited to this, and, as for other car ****, a driver detects and judges by vision that a communication link record unit exists by the manual within limits which can be radiocommunicated. The falling-stone S detection information transmitting command to the other car or the communication link record unit which operates the input section 18 and is located within limits which can be radiocommunicated can also be transmitted to a controller 15. At this time, a controller 15 transmits falling-stone S detection information to the other car or the communication link record unit located within limits which can be radiocommunicated like step S4 or step S10 according to the transmitted falling-stone S detection information transmitting command.

[0065] Moreover, in processing of step S7 mentioned above, although it judges automatically that car 2b and 2c have run by transmitting the signal for car recognition and receiving a reply signal within limits which can radiocommunicate in the communication link record unit four a1 and the communication device 25 of four a2, this invention is not limited to this.

[0066] For example, instead of step S7, the driver of car 2b and 2c may detect and judge by vision that the communication link record unit four a1 and four a2 exist within limits [a self-car] which can be radiocommunicated by the manual, and may transmit an information Request to Send to the communication link record unit four a1 which operates the input section 18 and is located within limits which can be radiocommunicated, and four a2.

[0067] At this time, decision of step S7 will serve as YES, and the communication link record unit four a1 and the communication device 25 of four a2 will perform falling-stone S detection information transmitting processing of step S7, if the above-mentioned information Request to Send is transmitted.

[0068] If one car detects generating of the abnormality event (falling stone) produced on the road and the crossing in which the infrastructure system facility containing a sensor, and control and the computer for communications processing of high cost is not installed with the camera for operation exchange according to this operation gestalt as stated above Indirect through the communication link record unit installed in the road side of a road in this detected abnormality event generating information Since it can transmit in advance to the other cars (a consecutiveness car, opposite car, etc.) which go to the above-mentioned abnormality event generating point next directly, or the other car Even if the infrastructure system facility containing the above-mentioned sensor, and control and the computer for communications processing of high cost is not installed in the road, abnormality event generating information can be acquired in advance than the time of abnormality event generating point attainment.

[0069] Therefore, since the other cars, such as a consecutiveness car and an opposite car, can run appropriately corresponding to the above-mentioned abnormality event generating of the detour transit mentioned above, for example, they can raise the safety and operational efficiency of road traffic.

[0070] According to this operation gestalt, moreover, each communication link record unit four a1 and the communication device 25 of four a2 Since abnormality event generating information, such as falling-stone S detection information transmitted from car 2a, can be transmitted to the traffic control pin center,large T, the traffic control pin center,large T Generating of the abnormality event produced on the road and the crossing in which the infrastructure system facility containing the above-mentioned sensor, and the control and the computer for communications processing which had taken time amount grasp and to recognize conventionally of high cost is not installed Since it can grasp and recognize simply and quickly, treatment corresponding to the generated abnormality event can be performed quickly, and the safety and operational efficiency of road traffic can be raised further.

[0071] In addition, with this operation gestalt, although the abnormality event was considered as falling stone, artificial outbreak events, such as sudden natural phenomena, such as a landslide, and high tide, a boulder flow, and a traffic accident, are also included that it cannot be overemphasized that this invention is not limited to this.

[0072] And in this operation gestalt, although generating of an abnormality event (falling stone) was detected, it is also possible for this invention not to be limited to this and to detect traffic situations, such as traffic congestion.

[0073] For example, as shown in drawing 8 , it is running the road RA top in which the infrastructure system facility containing the sensor, and the control and the computer for communications processing which 2h of a certain cars mentioned above is not installed toward a crossing C3. The traffic situation on the road RA (the signal of a crossing C3 is yellow and those with oncoming car both 2i which turn to the right) is interrupted by large-sized forward vehicle both 2j, and presupposes that it is a dead angle (outside of a visual field) from the driver of 2h of self-cars.

[0074] even in this case, processing of steps S1, S2, and S10 of drawing 4 , and step S11 -- being the same (falling-stone S detection information changing to traffic situation detection information) -- The traffic situation detection information containing the front image photoed with the camera 10 (front camera 11) for operation

exchange of forward vehicle both 2j, i.e., the image showing the traffic situation by the side of the self-car front It is transmitted to 2h of consecutiveness cars located within limits [forward vehicle both 2j] which can be radiocommunicated by processing of a controller 15 (step S1, step S2, and step S10 reference), and is displayed on the display 17 in 2h of consecutiveness cars.

[0075] The driver of 2h of consecutiveness cars consequently, by seeing the traffic situation detection information displayed on the display 17 Since it can recognize in advance that the traffic situation besides a visual field, i.e., the signal of a crossing C3, has that it is yellow and opposite right-turn car 2i, It can have allowances also in a rapid signal change, and it can be coped with, and generating of the collision with opposite right-turn car 2i etc. can be avoided, and the safety and operational efficiency of road traffic can be raised.

[0076] And although the operation gestalt mentioned above explained the case where the other cars, such as a consecutiveness vehicle and an oncoming car, were one set at a time, respectively, this invention is not limited to this.

[0077] Namely, as shown in drawing 9 (A) [when 3 and ... are running 2m cars / of two or more consecutiveness cars / 2 or 2m / 3, ..., 2n of consecutiveness cars / 2 or 2n following 1, respectively 2m 1 and 2n of its opposite car of cars which detected the traffic situation and the abnormality event with the camera 10 for operation exchange carried in the self-car] 2m 1 and 2m of consecutiveness cars which received 2 the traffic situation /n of abnormality event detection information from 1 of detection cars 2 and 2n2 It is [2m of consecutiveness cars of a self-car] also possible 3 and to transmit 2 the traffic situation /n of abnormality event detection information to 3, and to transmit a traffic situation / abnormality event detection information to a sequential consecutiveness car hereafter. Consequently, all the cars that follow can acquire a traffic situation / abnormality event detection information in advance, and can contribute to the improvement in safety of road traffic, and improvement in operational efficiency.

[0078] moreover, the car (a forward vehicle -- both -- 2sk-2, 2sk-1, consecutiveness car 2sk+1, and an oncoming car -- both -- 2tk-1 -- 2 tk) of plurality [within the limits / of car 2sk which detected the traffic situation and the abnormality event with the camera 10 for operation exchange carried in the self-car as shown in drawing 9 (B) / radio intelligence ready-for-sending ability] [when 2tk+1 is running] detection car 2sk It is also possible to transmit a traffic situation / abnormality event detection information to all the cars (1 forward vehicle both 2sk(s)- 2, 2sk- 1 and consecutiveness car 2sk+ 1, oncoming car both 2tk(s)- two tk, 2tk+ 1) of the wireless ready-for-sending ability within the limits. Consequently, all the cars that run wireless ready-for-sending ability within the limits of a traffic situation / abnormality event detection car can acquire a traffic situation / abnormality event detection information, and can contribute to the improvement in safety of road traffic, and improvement in operational efficiency.

[0079] Furthermore, as shown in drawing 9 (C), it passes to opposite car 2yk which passes, respectively, 2yk+1, ... and opposite car 2xk, 2xk+1, and ..., and car 2x which detected the traffic situation and the abnormality event with the camera 10 for operation exchange carried in the self-car, and car 2y of the opposite lane can also sometimes transmit a traffic situation / abnormality event detection information. Consequently, all the opposite cars that pass by the traffic situation / abnormality event detection car can acquire a traffic situation / abnormality event detection information in advance, and can contribute it to the improvement in safety of road traffic, and improvement in operational efficiency.

[0080] In addition, in this operation gestalt, as a medium of car-to-car radio, although the electric wave of for example, a millimeter wave band is used, this invention is not limited to this and can also use a different medium from an infrared electric wave.

[0081] Moreover, in this operation gestalt, although the communication link record unit has the recording device and a traffic situation / abnormality event detection information was recorded on this recording device, this invention is not limited to this and may use the communication link unit which has the communication facility between the traffic control pin center,larges T equipped only with the communication device mentioned above as a substitute of the communication link record unit of this operation gestalt (junction function).

[0082] When this communication link unit is used and a traffic situation / abnormality event detection information is transmitted to a traffic control pin center,large from a predetermined car via a certain communication link unit (transmitting agency communication link unit), By transmitting the above-mentioned traffic situation / abnormality event detection information to the communication link unit around a transmitting agency communication link unit (transmission place communication link unit) from a traffic control pin center,large Since the above-mentioned traffic situation / abnormality event detection information can be transmitted from each transmission place communication link unit to the other cars, such as a car which follows the above-mentioned predetermined car, the same effectiveness as this operation gestalt can be acquired.

[0083] Furthermore, in this operation gestalt, as a traffic situation / an abnormality event detection image, although the image of a front camera was used, it is also possible for this invention not to be limited to this and to use the image of a side camera or the image of both cameras.

[0084] And in this operation gestalt, although the camera for obstruction detection was used as a camera for

operation exchange, this invention is not limited to this and may use other cameras for operation exchange, such as a camera for lane detection, and a camera for collision prevention.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] The block diagram showing the outline configuration of the car-to-car communication system concerning the gestalt of operation of this invention.
[Drawing 2] The perspective view showing the installation location to the car of the camera for operation exchange in the car-to-car communication system shown in drawing 1 .
[Drawing 3] Drawing for explaining the indirect abnormality event detection information communications processing actuation between the cars which run the road that the infrastructure system facility containing a sensor, and control and the computer for communications processing is not installed.
[Drawing 4] The outline flowchart for explaining the whole actuation concerning the above-mentioned indirect abnormality event detection information communications processing of the car-to-car communication system concerning this operation gestalt.
[Drawing 5] Drawing for explaining the indirect abnormality event detection information communications processing actuation between the cars which run the road that the infrastructure system facility containing a sensor, and control and the computer for communications processing is not installed.
[Drawing 6] Drawing for explaining the indirect abnormality event detection information communications processing actuation between the cars which run the road that the infrastructure system facility containing a sensor, and control and the computer for communications processing is not installed.
[Drawing 7] Drawing for explaining the direct abnormality event detection information communications processing actuation between the cars which run the road that the infrastructure system facility containing a sensor, and control and the computer for communications processing is not installed.
[Drawing 8] Drawing for explaining the direct traffic situation detection information communications processing actuation between the cars which run the road that the infrastructure system facility containing a sensor, and control and the computer for communications processing is not installed.
[Drawing 9] Drawing showing the actuation which carries out sequential transmission of an abnormality event / the traffic situation detection information on a consecutiveness car as an example of development of a direct car-to-car communication, and (B) (A) Drawing where an abnormality event / traffic situation detection car shows the actuation which transmits an abnormality event / traffic situation detection information to all the cars within the limits which can be radiocommunicated as an example of development of a direct car-to-car communication, and (C) Drawing showing the actuation which transmits an abnormality event / traffic situation detection information as an example of development of a direct car-to-car communication to the opposite car with which an abnormality event / traffic situation detection car passes each other.
[Description of Notations]
1 Car-to-car Communication System
2, 2a-2d, 2h-2j, 2m1-2m3, 2n1-2n3, 2sk-2-2sk+1, 2tk-1-2tk+1, 2y, 2yk-2yk+2, 2xk, 2xk+1 Car
3 Car-to-car Unit
4 Communication Link Record Unit
10 Camera for Operation Exchange
11 Camera for Forward Cardiac Failure Theory Object Detection
12 Camera for Lateral Obstacle Detection
15 Controller
16 Memory
17 Display
18 Input Section
19 Communications Department
25 Communication Device
26 Recording Device
T Traffic control pin center,large

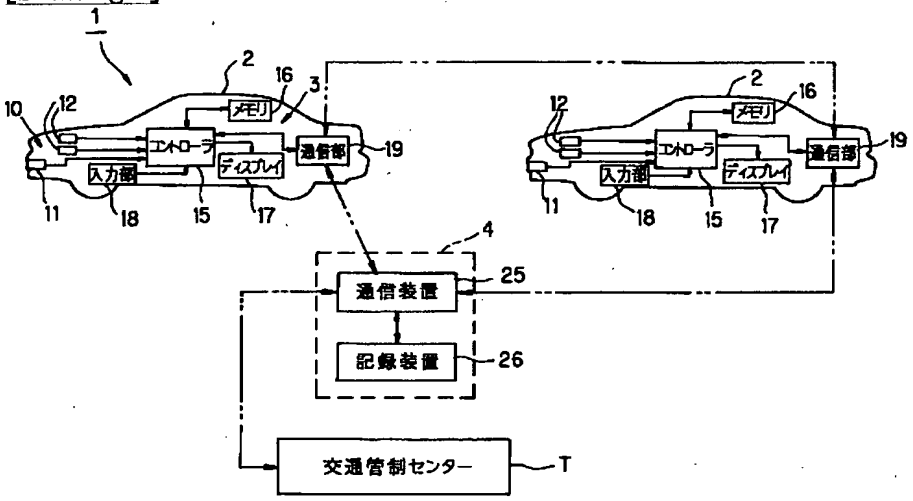
[Translation done.]

* NOTICES *

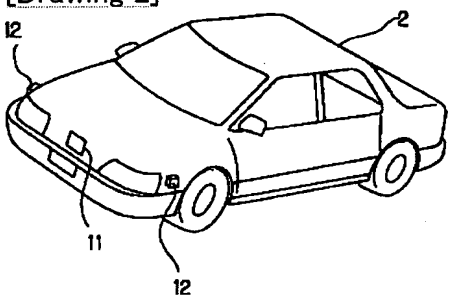
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

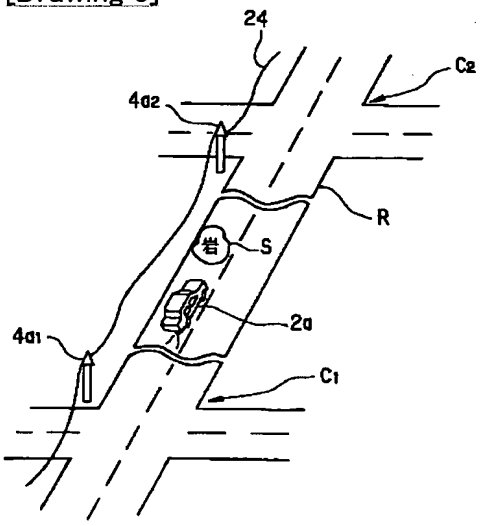
[Drawing 1]



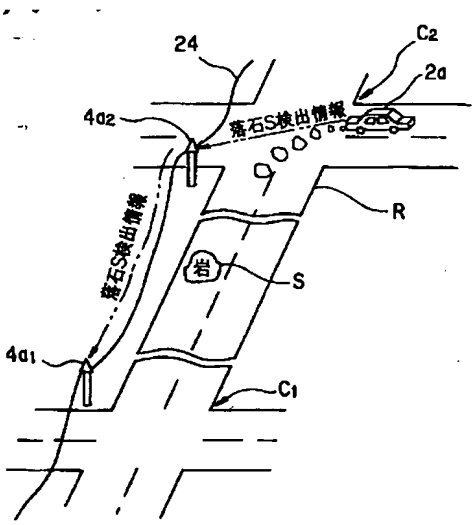
[Drawing 2]



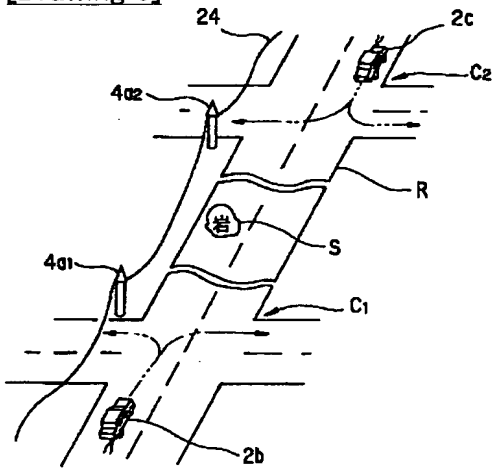
[Drawing 3]



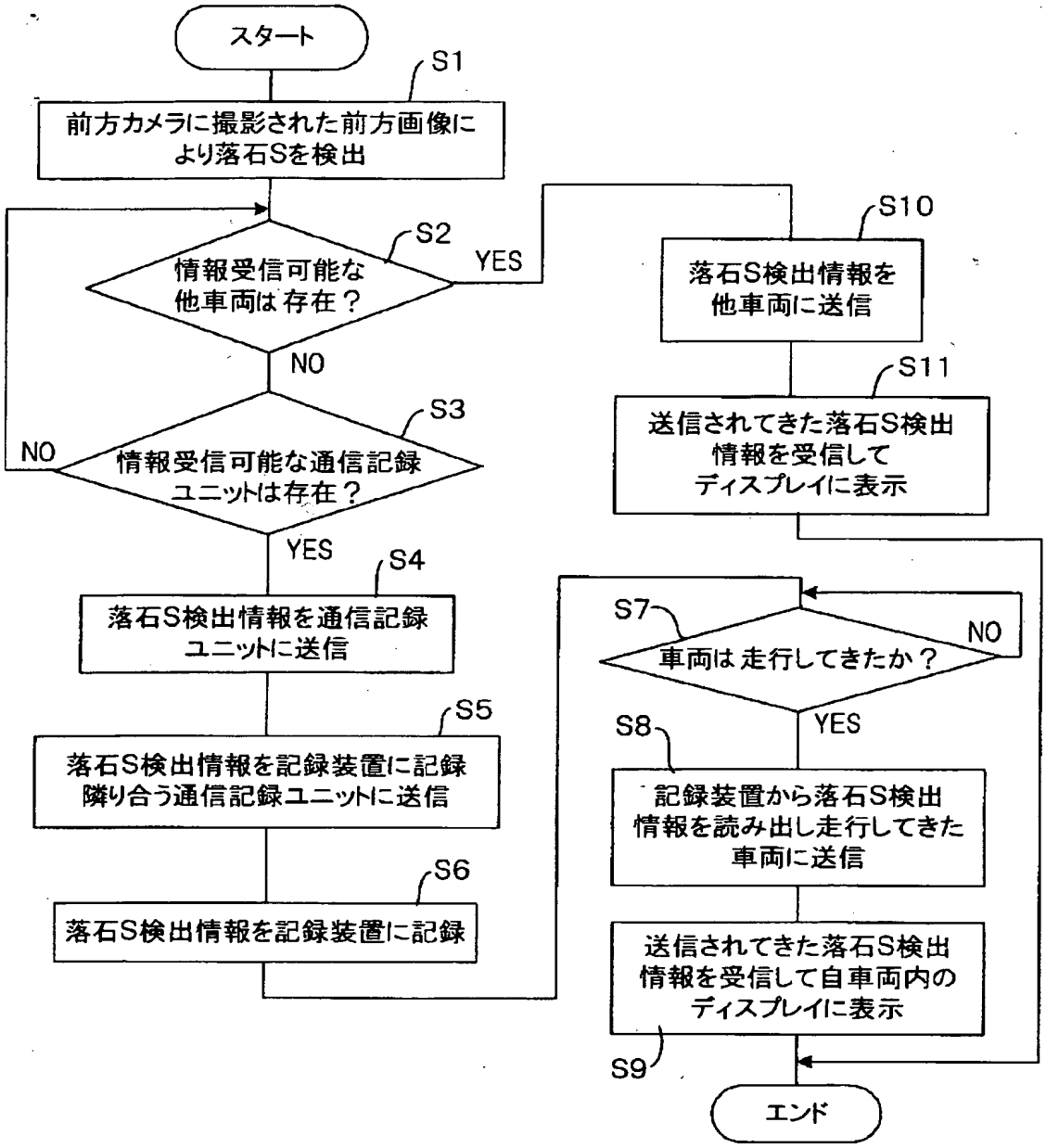
[Drawing 5]



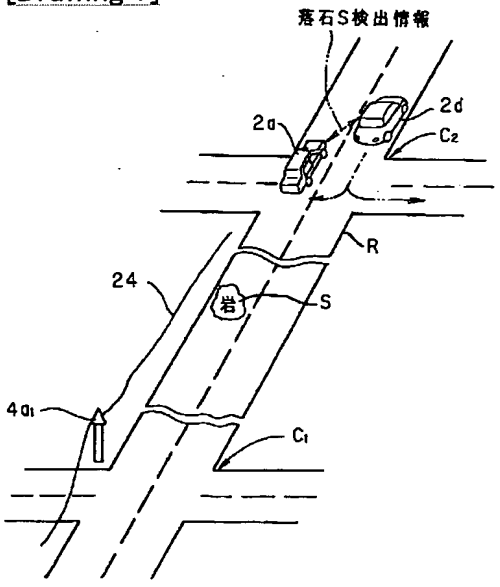
[Drawing 6]



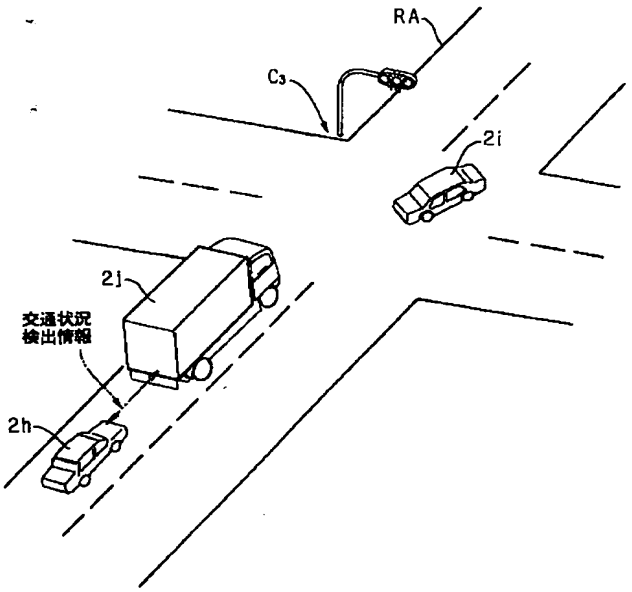
[Drawing 4]



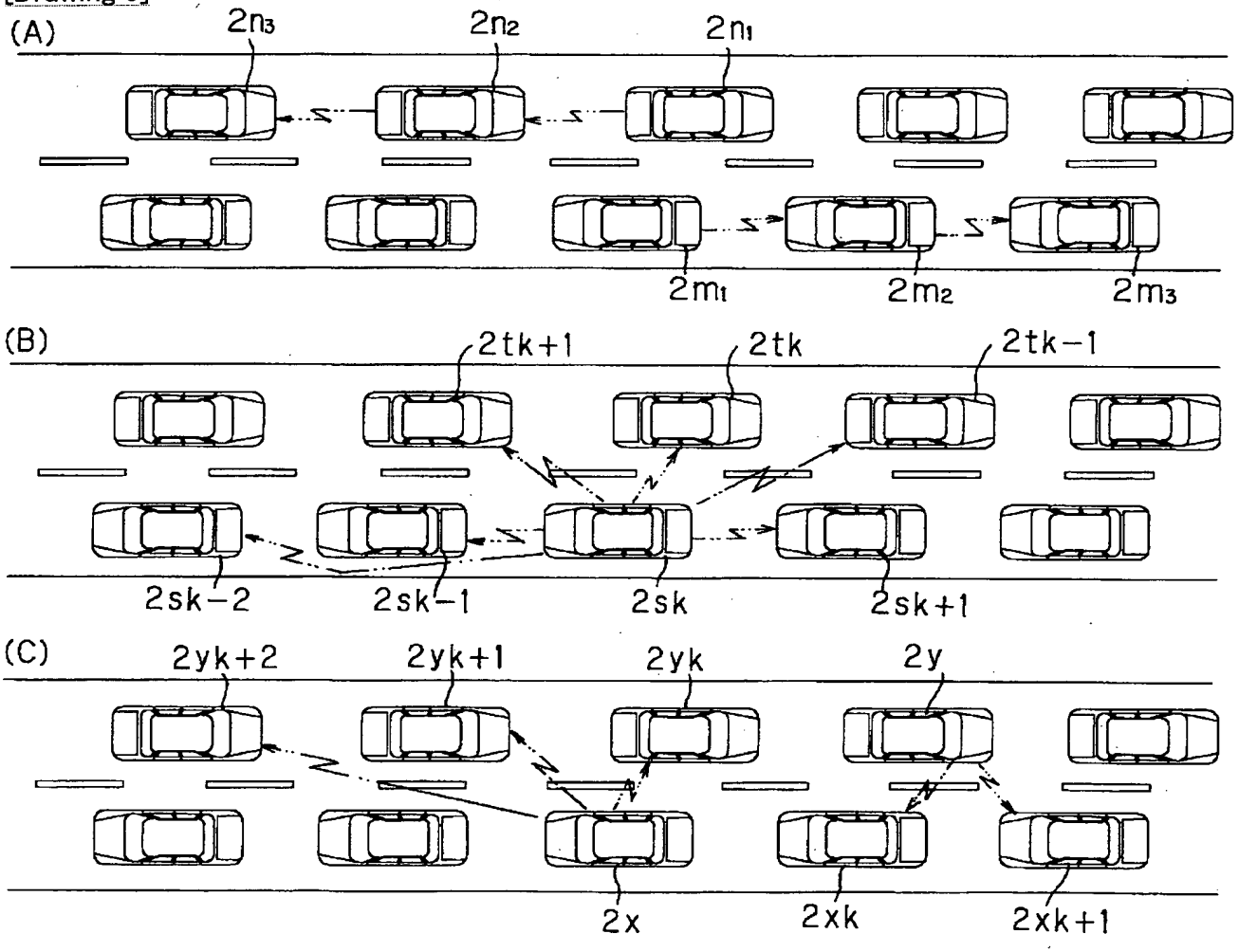
[Drawing 7]



[Drawing 8]



[Drawing 9]



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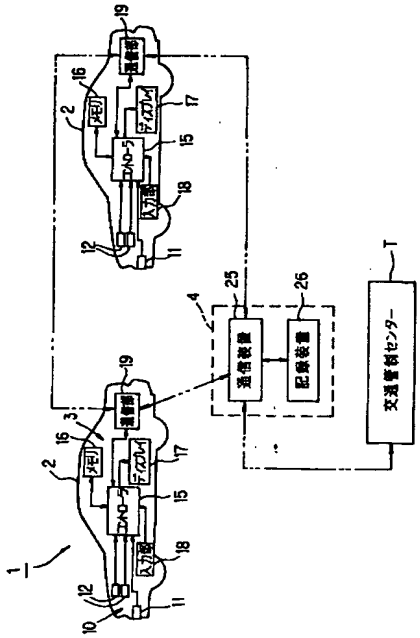
最終頁に続く

(54)【発明の名称】　車車間通信システム

(57)【要約】
【課題】高コストのインフラ系設備が設置されていない道路上の交通状況・異常事象の発生を全ての車両が事前に認知することを可能にする。
【解決手段】センサと制御および通信処理用コンピュータとを有するインフラ系設備が未設置の道路上を走行する複数の車両２間において情報を通信可能な車車間通信システム１。各車両２は、運転支援用として自車両２に搭載され、自車両２の周囲の画像を撮影する運転支援用カメラ１０（１１、１２）と、撮影された周囲画像に基づいて、自車両２周囲の交通状況および異常事象の内の少なくとも一方を含む走行関連情報を検出する処理、および検出された走行関連情報を他車両に無線で送信する処理を行なうコントローラ１５および通信部１９とを備えている。



【特許請求の範囲】

【請求項１】　道路上を走行する複数の車両間において情報を通信可能な車車間通信システムであって、

前記各車両は、運転支援用として自車両に搭載され、当該自車両の周囲の画像を撮影する画像撮影手段と、撮影された周囲画像に基づいて、自車両周囲の交通状況および異常事象の内の少なくとも一方を含む走行関連情報を検出する検出手段と、この検出手段により検出された走行関連情報を他車両に無線で送信する無線送信手段とを備えたことを特徴とする車車間通信システム。

【請求項２】　前記各車両は、他車両から自車両に対して送信されてきた走行関連情報を受信する受信手段と、受信された走行関連情報を表示する表示手段とを備えたことを特徴とする請求項１記載の車車間通信システム。

【請求項３】　前記無線送信手段は、自車両の無線通信可能範囲内に後続車両および対向車両の内の少なくとも一方が存在する際に、その少なくとも一方の車両に対して前記走行関連情報を直接送信する手段を有したことを特徴とする請求項２記載の車車間通信システム。

【請求項４】　前記無線送信手段は、自車両の無線通信可能範囲内に存在する全ての車両に前記走行関連情報を直接送信する手段を有したことを特徴とする請求項２記載の車車間通信システム。

【請求項５】　前記複数の車両が前記道路上において所要の車間距離を隔てて並んでいる際に、前記複数の車両の受信手段は、自車両の進行方向前方側の先行車両から前記走行関連情報が送信されてきた際に、当該走行関連情報を受信し、受信した走行関連情報を自車両に後続する車両に対して直接送信する手段を備えたことを特徴とする請求項２記載の車車間通信システム。

【請求項６】　前記無線送信手段は、自車両に対してすれ違う対向車線上の対向車両に前記走行関連情報を送信する手段を有したことを特徴とする請求項２記載の車車間通信システム。

【請求項７】　前記無線送信手段は、前記道路の近傍に所定間隔を空けて互いに通信可能に設置された前記走行関連情報記録用および通信用の複数の記録通信装置と、前記自車両の無線通信可能範囲内に他車両が存在するか否かを判断する判断手段と、この判断手段の判断の結果、他車両が存在しない際に前記走行関連情報を前記自車両の無線通信可能範囲内に位置する記録通信装置に送信する送信手段とを備え、前記記録通信装置は、送信されてきた走行関連情報を記録する記録手段と、記録された走行関連情報を、隣接する他の記録通信装置に対して送信する第１の送信手段と、他記録通信装置から送信されてきた走行関連情報を受信する受信手段と、前記走行関連情報検出車両に続いて前記走行関連情報検出地点に向かうために自記録通信装置近傍を走行している他車両に対して、前記受信手段により受信された走行関連情報を送信する第２の送信手段とを備えたことことを特徴とする請求項２記載の車車間通信システム。

【請求項８】　前記無線送信手段は、前記道路の近傍に所定間隔を空けて設置された前記走行関連情報通信用の複数の通信装置と、この通信装置と情報通信可能に接続された前記走行関連情報管理用の情報管理装置と、前記自車両の無線通信可能範囲内に他車両が存在するか否かを判断する判断手段と、この判断手段の判断の結果、他車両が存在しない際に前記走行関連情報を前記自車両の無線通信可能範囲内に位置する通信装置に送信する手段とを備え、

前記通信装置は、前記送信手段により送信されてきた走行関連情報を前記情報管理装置に送信する第１の送信手段を備え、前記情報管理装置は、送信されてきた走行関連情報を、送信元の通信装置の周囲の他の通信装置に送信する手段を備え、前記他の通信装置は、前記走行関連情報検出車両に続いて前記走行関連情報検出地点に向かうために当該他通信装置近傍を走行している他車両に対して、前記情報管理装置から送信されてきた走行関連情報を送信する第２の送信手段とを備えたことことを特徴とする請求項２記載の車車間通信システム。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】道路上を走行する車両間（車車間）において当該各車両の走行に関連する情報を直接的および間接的に通信できる車車間通信システムに関する。

【０００２】

【従来の技術】社会の発展に応じて道路交通の需要は急激に増加しており、道路交通の安全性を向上させることは、現在から未来に向けて解決しなければならない大きな課題である。

【０００３】こうした背景を踏まえて、近年では、ＩＴＳ（Ｉｎｔｅｌｌｉｇｅｎｔ　Ｔｒａｎｓｐｏｒｔ　Ｓｙｓｔｅｍ；高度道路交通システム）への移行が鋭意進められている。

【０００４】このようなＩＴＳを実現するためには、渋滞等の交通状況の収集や車両走行に異常をきたす事象等を含む車両の走行に関連する情報（走行関連情報）を早期に検出し、検出情報を各車両のドライバにフィードバックすることが大変重要になっている。

【０００５】上記交通状況収集および異常事象検出を行なうインフラ系の設備としては、交差点を含む道路の路側等に所定間隔を空けて複数個設置された可視光カメラ（例えばＣＣＤカメラ）等の画像処理センサを含むセンサと、各センサに応じて１台ずつ設けられ、そのセンサの検出処理に関する制御および検出データを交通管制センターに送信する処理を行なう制御・通信処理用コンピュータとが必要である。

【０００６】一方、交通管制センターからフィードバックされた情報をモニタする車載系の設備としては、予め

車両にカーナビゲーションシステムの一部として搭載されたディスプレイを利用したものが一般的である。

【０００７】

【発明が解決しようとする課題】上述したように、交通状況収集および異常事象検出を行なうためには、各センサあたり１台の制御・通信処理用コンピュータが必要であるため、特に、検出範囲を広くとることが要求されるインフラ系設備（センサおよび制御・通信処理用コンピュータ）においては、処理する情報量が増加し、その情報量増加に比例して制御・通信処理用コンピュータに要求される能力も高くなる傾向があるため、結果として一つのセンサを含むインフラ系設備のコストも高くなる。

【０００８】すなわち、全ての道路に上述したインフラ系の設備（検出器および制御・通信処理用コンピュータ）を設置することがＩＴＳの理想であるが、上述した各インフラ系設備自体のコストおよび設置コストの関係上現実的ではなく、さらに、交通量の少ない道路・交差点では、仮に上記インフラ系設備を設置しても、無駄時間が長くなり非効率的であるため、交通量の多い道路・交差点のみに設置するようになっている。

【０００９】したがって、交通量が少なく、上記センサおよび制御・通信処理用コンピュータを含むインフラ系設備が設置されていない道路・交差点においては、交通状況収集および異常事象検出を行なうことが困難であった。

【００１０】この結果、仮に上記インフラ系設備が設置されていない道路・交差点において、事故の発生、交通渋滞、および落石・がけ崩れ等の危険状況が発生していても、その場所を通る車両、後続車両および対向車両は、上記事故、交通渋滞および危険状況発生等を事前に認知することができず、道路交通の安全性向上を阻害し、道路交通の運行効率を悪化させていた。

【００１１】本発明は上述した事情に鑑みてなされたもので、センサおよび制御・通信処理用コンピュータを含む高コストのインフラ系設備が設置されていない道路・交差点上に生じている交通状況および異常事象の発生を、上記道路・交差点を通る全ての車両が事前に認知することができる車車間通信システムを提供することをその目的とする。

【００１２】

【課題を解決するための手段】近年、車載系の設備として、道路上の障害物検出用、車線検出用、衝突防止用等の運転支援用カメラ｛ＣＣＤカメラ（ＴＶカメラ）等｝を各車両に搭載することにより、ドライバの運転を支援して道路交通の安全性を向上させる研究開発が進められている。

【００１３】そこで、本発明者等は、上記運転支援用カメラが各車両に搭載されていることに着目して本願発明を考案した。

【００１４】すなわち、上述した目的を達成するための発明によれば、道路上を走行する複数の車両間において情報を通信可能な車車間通信システムであって、前記各車両は、運転支援用として自車両に搭載され、当該自車両の周囲の画像を撮影する画像撮影手段と、撮影された周囲画像に基づいて、自車両周囲の交通状況および異常事象の内の少なくとも一方を含む走行関連情報を検出する検出手段と、この検出手段により検出された走行関連情報を他車両に無線で送信する無線送信手段とを備えている。

【００１５】本発明において、前記各車両は、他車両から自車両に対して送信されてきた走行関連情報を受信する受信手段と、受信された走行関連情報を表示する表示手段とを備えている。

【００１６】本発明において、前記無線送信手段は、自車両の無線通信可能範囲内に後続車両および対向車両の内の少なくとも一方が存在する際に、その少なくとも一方の車両に対して前記走行関連情報を直接送信する手段を有している。

【００１７】本発明において、前記無線送信手段は、自車両の無線通信可能範囲内に存在する全ての車両に前記走行関連情報を直接送信する手段を有している。

【００１８】本発明において、前記複数の車両が前記道路上において所要の車間距離を隔てて並んでいる際に、前記複数の車両の受信手段は、自車両の進行方向前方側の先行車両から前記走行関連情報が送信されてきた際に、当該走行関連情報を受信し、受信した走行関連情報を自車両に後続する車両に対して直接送信する手段を備えている。

【００１９】本発明において、前記無線送信手段は、自車両に対してすれ違う対向車線上の対向車両に前記走行関連情報を送信する手段を有している。

【００２０】本発明において、前記無線送信手段は、前記道路の近傍に所定間隔を空けて互いに通信可能に設置された前記走行関連情報記録用および通信用の複数の記録通信装置と、前記自車両の無線通信可能範囲内に他車両が存在するか否かを判断する判断手段と、この判断手段の判断の結果、他車両が存在しない際に前記走行関連情報を前記自車両の無線通信可能範囲内に位置する記録通信装置に送信する送信手段とを備え、前記記録通信装置は、送信されてきた走行関連情報を記録する記録手段と、記録された走行関連情報を、隣接する他の記録通信装置に対して送信する第１の送信手段と、他記録通信装置から送信されてきた走行関連情報を受信する受信手段と、前記走行関連情報検出車両に続いて前記走行関連情報検出地点に向かうために自記録通信装置近傍を走行している他車両に対して、前記受信手段により受信された走行関連情報を送信する第２の送信手段とを備えている。

【００２１】本発明において、前記無線送信手段は、前記道路の近傍に所定間隔を空けて設置された前記走行関

連情報通信用の複数の通信装置と、この通信装置と情報通信可能に接続された前記走行関連情報管理用の情報管理装置と、前記自車両の無線通信可能範囲内に他車両が存在するか否かを判断する判断手段と、この判断手段の判断の結果、他車両が存在しない際に前記走行関連情報を前記自車両の無線通信可能範囲内に位置する通信装置に送信する手段とを備え、前記通信装置は、前記送信手段により送信されてきた走行関連情報を前記情報管理装置に送信する第１の送信手段を備え、前記情報管理装置は、送信されてきた走行関連情報を、送信元の通信装置の周囲の他の通信装置に送信する手段を備え、前記他の通信装置は、前記走行関連情報検出車両に続いて前記走行関連情報検出地点に向かうために当該他通信装置近傍を走行している他車両に対して、前記情報管理装置から送信されてきた走行関連情報を送信する第２の送信手段とを備えている。

【００２２】

【発明の実施の形態】本発明の実施の形態を添付図面を参照して説明する。

【００２３】図１は、本実施形に係る車車間通信システム１の概略構成を示すブロック図である。

【００２４】図１によれば、車車間通信システム１は、各車両２に搭載され車両間（車車間）の通信を直接的かつ間接的に行なうための車車間通信ユニット３と、車両間の間接的通信の際に、車両２から送信された情報を記録する機能および情報通信機能を有する通信記録ユニット４とを備えている。

【００２５】本実施形態において、通信記録ユニット４は、交通量が少なく、センサおよび制御・通信処理用コンピュータを含むインフラ系設備が設置されていない道路および交差点の路側に所定間隔を空けて設置されている。

【００２６】車車間通信ユニット３は、道路上の障害物検出用、車線検出用、衝突防止用等の運転支援用カメラ１０を備えている。本実施形態においては、運転支援用カメラ１０として、図２に示すように、各車両２の前方障害物検出用カメラ１１が自車両の車体前方側（例えばナンバプレート上方）に取り付けられており、さらに、運転支援用カメラ１０として、自車両の両側方側の障害物を検出するための側方障害物検出用カメラ１２が各車両２の車体の両側方側（例えば車体前方の左右両側）に取り付けられている。

【００２７】前方障害物検出用カメラ（以下、前方カメラと略記する）１１は、自車両前方側の画像を撮影し、側方障害物検出用カメラ（以下、側方カメラと略記する）１２は、自車両側方側の画像を撮影するようになっている。

【００２８】また、車車間通信ユニット３は、ユニット全体を統括制御するためのコントローラ１５と、このコントローラ１５の処理プログラムおよび処理に必要なデータを記憶するためのメモリ１６と、画像表示用のディスプレイ１７とを備えている。

【００２９】車車間通信ユニット３のコントローラ１５は、前方カメラ１１および側方カメラ１２の撮影処理を制御する機能、前方カメラ１１により撮影された前方画像、および側方カメラ１２により撮影された側方画像に基づいて、例えば各ピクセル値の輝度や色の違いにより前方側道路平面上を含む前方側障害物および側方側の障害物を自動的に検出する機能、撮影された前方画像および側方画像に基づいて、例えば差分処理やパターンマッチング処理等により前方の道路上および側方の車線（対向車線等）に渋滞が発生しているか否かを自動的に検出する機能、撮影された前方画像および側方画像をメモリ１６に記憶する機能および撮影された前方画像および側方画像を、交互あるいは並べてディスプレイ１７に表示する機能を有している。

【００３０】すなわち、コントローラ１５は、前方カメラ１１および側方カメラ１２の内の少なくとも一方により撮影された画像に基づいて、その前方および側方の内の少なくとも一方における障害物の存在等の異常事象や渋滞等の交通状況を含む自車両・他車両の走行に関連する情報（走行関連情報）を検出することができる。

【００３１】そして、車車間通信ユニット３は、コントローラ１５に接続され、コントローラ１５に対して自車両２内のドライバあるいは同乗者の操作により、例えば交通状況および異常事象の発生を表す情報送信指令や、その交通状況および異常事象の発生を表す画像送信指令等の指令を入力可能な入力部１８とを備えている。

【００３２】さらに、車車間通信ユニット３は、例えばミリ波帯の電波による無線方式で情報を通信可能な通信部１９を備えている。

【００３３】そして、本実施形態の車車間通信ユニット３のコントローラ１５および通信部１９は、自車両位置に対して予め定まる無線通信可能範囲（例えば、半径数十メートルまでの範囲）に位置する他車両（後続車両、前方車両、対向車両等）との間で無線で情報を通信する機能、および自車両位置に対して無線通信可能範囲内に位置する通信記録ユニット４に対して撮影画像等の情報を送信する機能および自車両位置に対して無線通信可能位置に配置された通信記録ユニット４に対して情報送信指令を送る機能等を備えている。

【００３４】一方、道路および交差点の路側に所定間隔を空けて設置されている複数の通信記録ユニット４（後述する通信装置２５）は、隣り合うユニット４自体（後述する通信装置２５）が相互に通信可能にケーブル２４で接続されている。

【００３５】そして、通信記録ユニット４は、車両２との間の情報通信処理および交通管制センターＴとの間の情報通信処理を行なう通信装置２５と、車両２から送信され通信装置２５を介して受信された撮影画像等の情報

を記録する記録装置２６とを備えている。

【００３６】次に本実施形態の車車間通信システム１の全体動作について説明する。

【００３７】本実施形態の車車間通信システム１の全体動作は、（１）自車両の周囲に他車両（対向車両、後続車両等）が無く、車両間での直接通信が困難な場合と、（２）自車両の周囲に他車両（対向車両、後続車両等）が存在して、車両間での直接通信が可能な場合とに大別できるため、以下、上記２つの場合についてそれぞれ説明する。

【００３８】（１）直接通信が困難な場合

例えば図３に示すように、ある車両２ａが上述したセンサおよび制御・通信処理用コンピュータを含むインフラ系設備が設置されず、通信記録ユニット４（４ａ１、４ａ２）が例えば交差点Ｃａ１、Ｃａ２、・・・毎に設置された道路Ｒ上における交差点Ｃ１とＣ２の間を走行しており、後続車も対向車も自車両２ａの周囲において走行していないものとする。

【００３９】そして、本実施形態においては、異常事象として落石が発生し、車両２ａの前方の道路上に障害物（落石）Ｓが置かれたものとする。なお、交通量が少ないため、交差点Ｃ１およびＣ２間の距離は長く、かつ交差点Ｃ１およびＣ２と落石Ｓとの距離も長くなっており、交差点Ｃ１およびＣ２からでは、ドライバは落石Ｓの認知が不可能であるものとする。

【００４０】このとき、車両２ａのコントローラ１５は、前方カメラ１１により撮影された前方画像（ディスプレイ１７に表示されている）に基づいて、上記障害物検出処理により障害物である落石Ｓを自動的に検出する（図４、ステップＳ１）。

【００４１】次いで、車両２ａのコントローラ１５は、自車両２ａの周囲に対して通信部１９を介して無線で他車両を認識するための信号（車両認識用信号）を送信して、情報受信可能な他車両が存在するか否かを判断する（ステップＳ２）。

【００４２】上述したように、自車両２ａの現在走行位置（落石Ｓ付近）において自車両２ａの周囲に無線で情報通信可能な他車両（対向車両、後続車両等）は存在しないため、ステップＳ２の判断はＮＯとなり、車両２ａのコントローラ１５は、自車両２ａの周囲に対して通信部１９を介して無線で通信記録ユニット４を認識するための信号（ユニット認識用信号）を送信して、情報受信可能な通信記録ユニット４が存在するか否かを判断する（ステップＳ３）。

【００４３】自車両２ａの現在走行位置（落石Ｓ付近）においては、その周囲に無線で情報通信可能な通信記録ユニットは存在しないため、ステップＳ３の判断はＮＯとなり、コントローラ１５は、ステップＳ２～Ｓ３の判断処理を車両２の進行（走行）に応じて繰り返し行なう。

【００４４】一方、車両２ａの走行が進んで自車両２ａが交差点Ｃ２に近付き、自車両２ａの無線情報通信可能範囲内に通信記録ユニット４ａ２が位置すると、通信ユニット４ａ２の通信装置２５から上記認識用信号に対する応答信号が車両２ａに送信される。

【００４５】通信記録ユニット４ａ２から応答信号が送信され通信部１９を介して受信されると、自車両２ａのコントローラ１５のステップＳ３の判断はＹＥＳとなり、コントローラ１５は、ステップＳ１の処理により撮影された落石Ｓが表示された画像を含む落石Ｓ検出情報を、無線通信可能範囲内に位置する通信記録ユニット４ａ２に送信する（ステップＳ４、図５参照）。

【００４６】通信記録ユニット４ａ２の通信装置２５は、送信されてきた落石Ｓ検出情報を記録装置２６に記録するとともに、その落石Ｓ検出情報を隣り合う通信記録ユニット（例えば通信記録ユニット４ａ１）の通信装置２５に送信し、また、必要に応じて交通管制センターＴに送信する（ステップＳ５）。

【００４７】通信記録ユニット４ａ１の通信装置２５は、送信されてきた落石Ｓ検出情報を記録装置２６に記録する（ステップＳ６）。

【００４８】この後、図６に示すように、道路Ｒ上を交差点Ｃ１に向かって後続車両２ｂが走行し、かつ対向車線において対向車両２ｃが交差点Ｃ２に向かって走行してきたとする。

【００４９】このとき、交差点Ｃ１およびＣ２の路側にそれぞれ設置された通信記録ユニット４ａ１および４ａ２の通信装置２５は、自ユニット４ａ１および４ａ２の周囲に対して無線で車両を認識するための信号（車両認識用信号）をそれぞれ送信しており、車両が走行してきたか否かを判断している（ステップＳ７）。

【００５０】ここで、通信記録ユニット４ａ１および４ａ２の周囲に無線で情報通信可能な車両が走行してきていない場合には、ステップＳ７の判断はＮＯとなり、通信装置１５は、ステップＳ７判断処理を繰り返し行なう。

【００５１】今、後続車両２ｂの無線通信可能範囲に通信記録ユニット４ａ１が位置し、対向車両２ｃの無線通信可能範囲に通信記録ユニット４ａ２が位置すると、後続車両２ｂおよび対向車両２ｃのコントローラ１５から通信部１９を介して上記車両認識用信号に対する応答信号が通信記録ユニット４ａ１および４ａ２にそれぞれ送信される。

【００５２】車両２ｂおよび２ｃから応答信号が送信されると、通信装置２５のステップＳ７の判断処理はＹＥＳとなり、通信記録ユニット４ａ１および４ａ２の通信装置２５は、記録装置２６に記録された落石Ｓ検出情報をそれぞれ読み出し、対応する後続車両２ｂおよび対向車両２ｃにそれぞれ送信する（ステップＳ８）。

【００５３】後続車両２ｂおよび対向車両２ｃのコント

ローラ１５は、送信されてきた落石Ｓ検出情報を通信部１９を介して受信し、受信した落石Ｓ検出情報をディスプレイ１７にそれぞれ表示する（ステップＳ９）。

【００５４】すなわち、車両２ａにより得られた落石Ｓ検出情報は、道路Ｒの路側に設置された通信記録ユニット４ａ１および４ａ２を介して間接的に他車両（後続車両２ｂおよび対向車両２ｃ）に送信されてディスプレイ１７に表示されたことになる。

【００５５】この結果、車両２ｂおよび２ｃを運転するドライバは、自車両２ｂおよび２ｃ内のディスプレイ１７に表示された落石Ｓ検出情報を見ることにより、交差点Ｃ１およびＣ２の進行方向前方には落石Ｓがあることを事前に認知することができ、交差点Ｃ１およびＣ２を例えば右折・左折（図６、２点鎖線参照）して落石Ｓを含む道路Ｒを迂回することができる。

【００５６】（２）直接通信が可能な場合

前掲図３において、交差点Ｃ２に通信記録ユニット４ａ２が設置されていない場合について考えてみる。

【００５７】このとき、交差点Ｃ１とＣ２の間を走行する車両２ａは、ステップＳ１の処理により車両２ａのコントローラ１５が落石Ｓを検出し、ステップＳ２およびステップＳ３において、自車両２ａの周囲に対して情報受信可能な他車両あるいは通信記録ユニットが存在するか否か判断する。

【００５８】自車両２ａの現在走行位置（落石Ｓ付近）においては、その周囲に無線で情報通信可能な他車両は存在しないため、ステップＳ２およびステップＳ３の判断は何れもＮＯとなり、コントローラ１５は、ステップＳ２～Ｓ３の判断処理を車両２の進行（走行）に応じて繰り返し行なう。

【００５９】そして、車両２ａが交差点Ｃ２を渡ったとき、道路Ｒ上の走行車線に対する対向車線を対向車両２ｄが走行して交差点Ｃ２に向かっており、その対向車両２ｅが車両２ａの無線情報通信可能範囲内に入ったとする。

【００６０】このとき、車両２ａのコントローラ１５のステップＳ２の判断の結果はＹＥＳとなり、コントローラ１５は、ステップＳ１の処理により撮影された落石Ｓ表示画像を含む落石Ｓ検出情報を、通信部１９を介して対向車両２ｄに送信する（ステップＳ１０）。

【００６１】対向車両２ｄのコントローラ１５は、送信されたきた落石Ｓ検出情報を通信部１９を介して受信し、受信した落石Ｓ検出情報をディスプレイ１７に表示する（ステップＳ１１）。

【００６２】すなわち、車両２ａにより得られた落石Ｓ検出情報は、直接他車両（対向車両）２ｄに送信されてディスプレイ１７に表示されたことになる。

【００６３】この結果、対向車両２ｄを運転するドライバは、自車両２ｄのディスプレイ１７に表示された落石Ｓ検出情報を見ることにより、交差点Ｃ２の進行方向前方には落石Ｓがあることを事前に認知することができ、交差点Ｃ２を例えば右折・左折（図７；２点鎖線参照）して落石Ｓを含む道路Ｒを迂回することができる。

【００６４】なお、上述したステップＳ２およびＳ３の処理において車両２ａのコントローラ１５は、他車両あるいは通信記録ユニット認識用信号を自車両２ａの周囲に送信して応答信号を受信することにより、情報受信可能な範囲内、すなわち無線通信可能範囲内に他車両あるいは通信記録ユニットが存在していることを自動的に判断しているが、本発明はこれに限定されるものではなく、ドライバが無線通信可能範囲内に他車両るいは通信記録ユニットが存在することを視覚によりマニュアルで検知・判断し、入力部１８を操作して無線通信可能範囲内に位置する他車両あるいは通信記録ユニットに対する落石Ｓ検出情報送信指令をコントローラ１５に送信することもできる。このとき、コントローラ１５は、送信された落石Ｓ検出情報送信指令に応じて、ステップＳ４あるいはステップＳ１０と同様に、落石Ｓ検出情報を無線通信可能範囲内に位置する他車両あるいは通信記録ユニットに送信するようになっている。

【００６５】また、上述したステップＳ７の処理において、通信記録ユニット４ａ１および４ａ２の通信装置２５は、車両認識用信号を送信して応答信号を受信することにより、無線通信可能な範囲内に車両２ｂおよび２ｃが走行してきたことを自動的に判断しているが、本発明はこれに限定されるものではない。

【００６６】例えば、ステップＳ７の代りに、車両２ｂおよび２ｃのドライバが自車両の無線通信可能範囲内に通信記録ユニット４ａ１および４ａ２が存在することを視覚によりマニュアルで検知・判断し、入力部１８を操作して無線通信可能範囲内に位置する通信記録ユニット４ａ１および４ａ２に対して情報送信要求を送信してもよい。

【００６７】このとき、通信記録ユニット４ａ１および４ａ２の通信装置２５は、上記情報送信要求が送信されてくるとステップＳ７の判断はＹＥＳとなり、ステップＳ７の落石Ｓ検出情報送信処理を行なうようになっている。

【００６８】以上述べたように、本実施形態によれば、センサおよび制御・通信処理用コンピュータを含む高コストのインフラ系設備が設置されていない道路・交差点上に生じた異常事象（落石）の発生を１台の車両が運転支援用カメラにより検出すると、この検出した異常事象発生情報を、道路の路側に設置された通信記録ユニットを介して間接的、あるいは直接的に次に上記異常事象発生地点に向かう他車両（後続車両、対向車両等）に対して事前に送信することができるため、他車両は、上記センサおよび制御・通信処理用コンピュータを含む高コストのインフラ系設備が道路に設置されていなくても、異常事象発生情報を、異常事象発生地点到達時よりも事前

に得ることができる。

【００６９】したがって、後続車両および対向車両等の他車両は、例えば上述した迂回走行等の上記異常事象発生に対応して適切に走行することができるため、道路交通の安全性および運行効率を向上させることができる。

【００７０】また、本実施形態によれば、各通信記録ユニット４ａ１、４ａ２の通信装置２５は、車両２ａから送信された落石Ｓ検出情報等の異常事象発生情報を交通管制センターＴに送信することができるため、交通管制センターＴは、従来把握・認識することに時間を要していた、上記センサおよび制御・通信処理用コンピュータを含む高コストのインフラ系設備が設置されていない道路・交差点上に生じた異常事象の発生を、簡単かつ迅速に把握・認識することができるため、発生した異常事象に対応する処置を迅速に行なうことができ、道路交通の安全性および運行効率をさらに向上させることができる。

【００７１】なお、本実施形態では、異常事象を落石としたが、本発明はこれに限定されないのは言うまでもなく、例えば、がけ崩れや高潮、土石流等の突発的な自然現象や交通事故等の人為的突発事象も含まれる。

【００７２】そして、本実施形態においては、異常事象（落石）の発生を検出するようにしたが、本発明はこれに限定されるものではなく、交通渋滞等の交通状況を検出することも可能である。

【００７３】例えば、図８に示すように、ある車両２ｈが上述したセンサおよび制御・通信処理用コンピュータを含むインフラ系設備が設置されていない道路ＲＡ上を交差点Ｃ３に向かって走行しており、その道路ＲＡ上の交通状況（交差点Ｃ３の信号が黄色、右折する対向車両２ｉあり）が大型の前方車両２ｊにより遮られ、自車両２ｈのドライバからは死角（視野外）となっているとする。

【００７４】この場合でも、図４のステップＳ１、Ｓ２、Ｓ１０およびステップＳ１１の処理と同様（落石Ｓ検出情報が交通状況検出情報に変わる）に、前方車両２ｊの運転支援用カメラ１０（前方カメラ１１）により撮影された前方画像、すなわち自車両前方側の交通状況を表す画像を含む交通状況検出情報は、コントローラ１５の処理により前方車両２ｊの無線通信可能範囲内に位置する後続車両２ｈに送信され（ステップＳ１、ステップＳ２およびステップＳ１０参照）、後続車両２ｈ内のディスプレイ１７上に表示される。

【００７５】この結果、後続車両２ｈのドライバは、ディスプレイ１７上に表示された交通状況検出情報を見ることにより、視野外の交通状況、すなわち、交差点Ｃ３の信号は黄色であること、および対向右折車両２ｉがあることを事前に認知することができるため、急激な信号変化にも余裕を持って対処することができ、かつ対向右折車両２ｉとの衝突等の発生を回避することができ、道路交通の安全性および運行効率を向上させることができる。

【００７６】そして、上述した実施形態では、後続車や対向車等の他車両がそれぞれ１台ずつの場合について説明したが、本発明はこれに限定されるものではない。

【００７７】すなわち、図９（Ａ）に示すように、自車両に搭載された運転支援用カメラ１０により交通状況や異常事象を検出した車両２ｍ１およびその対向車両２ｎ１に続いて複数の後続車両２ｍ２、２ｍ３、・・・および後続車両２ｎ２、２ｎ３、・・・がそれぞれ走行している場合において、検出車両２ｍ１および２ｎ１から交通状況／異常事象検出情報を受け取った後続車両２ｍ２および２ｎ２は、自車両の後続車両２ｍ３および２ｎ３に交通状況／異常事象検出情報を送信し、以下、順次後続車両に対して交通状況／異常事象検出情報を送信することも可能である。この結果、後続する全ての車両が事前に交通状況／異常事象検出情報を獲得することができ、道路交通の安全性向上および運行効率の向上に寄与することができる。

【００７８】また、図９（Ｂ）に示すように、自車両に搭載された運転支援用カメラ１０により交通状況や異常事象を検出した車両２ｓｋの無線情報送信可能範囲内に複数の車両（前方車両２ｓｋ－２、２ｓｋ－１、後続車両２ｓｋ＋１、対向車両２ｔｋ－１、２ｔｋ、２ｔｋ＋１）が走行している場合において、検出車両２ｓｋは、その無線送信可能範囲内の全ての車両（前方車両２ｓｋ－２、２ｓｋ－１、後続車両２ｓｋ＋１、対向車両２ｔｋ－１、２ｔｋ、２ｔｋ＋１）に対して交通状況／異常事象検出情報を送信することも可能である。この結果、交通状況／異常事象検出車両の無線送信可能範囲内を走行する全ての車両が交通状況／異常事象検出情報を獲得することができ、道路交通の安全性向上および運行効率の向上に寄与することができる。

【００７９】さらに、図９（Ｃ）に示すように、自車両に搭載された運転支援用カメラ１０により交通状況や異常事象を検出した車両２ｘおよび対向車線の車両２ｙは、それぞれすれ違う対向車両２ｙｋ、２ｙｋ＋１、・・・および対向車両２ｘｋ、２ｘｋ＋１、・・・に対してすれ違い時に交通状況／異常事象検出情報を送信することも可能である。この結果、交通状況／異常事象検出車両にすれ違う全ての対向車両は、事前に交通状況／異常事象検出情報を獲得することができ、道路交通の安全性向上および運行効率の向上に寄与することができる。

【００８０】なお、本実施形態においては、車車間無線通信の媒体として、例えばミリ波帯の電波を用いているが、本発明はこれに限定されるものではなく、赤外線等の電波とは異なる媒体を用いることもできる。

【００８１】また、本実施形態においては、通信記録ユニットは記録装置を有しており、この記録装置に交通状況／異常事象検出情報を記録したが、本発明はこれに限

定されるものではなく、本実施形態の通信記録ユニットの代りとして、上述した通信装置のみを備えた交通管制センターTとの間の通信機能（中継機能）を有する通信ユニットを用いてもよい。

【００８２】この通信ユニットを用いた場合においては、所定の車両からある通信ユニット（送信元通信ユニット）を経由して交通状況／異常事象検出情報が交通管制センターに送信された場合、交通管制センターから送信元通信ユニットの周囲の通信ユニット（送信先通信ユニット）に上記交通状況／異常事象検出情報を送信することにより、上記所定車両に後続する車両等の他車両に対して各送信先通信ユニットから上記交通状況／異常事象検出情報を送信することができるため、本実施形態と同様の効果を得ることができる。

【００８３】さらに、本実施形態においては、交通状況／異常事象検出画像として、前方カメラの画像を用いたが、本発明はこれに限定されるものではなく、側方カメラの画像、あるいは両方のカメラの画像を用いることも可能である。

【００８４】そして、本実施形態においては、運転支援用カメラとして障害物検出用カメラを用いたが、本発明はこれに限定されるものではなく、例えば車線検出用カメラや衝突防止用カメラ等の他の運転支援用カメラを用いてもよい。

【００８５】

【発明の効果】以上述べたように、本発明の車車間通信システムによれば、センサおよび制御・通信処理用コンピュータを含む高コストのインフラ系設備が非設置の道路上の異常事象発生や交通状況等の走行関連情報を１台の車両が運転支援用画像撮影手段により検出すると、この検出した走行関連情報を、道路の近傍に設置された記録通信装置や通信装置等を介して間接的、あるいは直接的に後続車両や対向車両等の他車両に対して送信することができるため、他車両は、上記センサおよび制御・通信処理用コンピュータを含む高コストのインフラ系設備が道路に設置されていなくても、異常事象や交通状況等の走行関連情報を事前に得ることができる。

【００８６】したがって、後続車両および対向車両等のドライバは、得られた走行関連情報に応じて自車両を適切に走行させることができるため、道路交通の安全性および運行効率を向上させることができる。

【図面の簡単な説明】

【図１】本発明の実施の形態に係る車車間通信システムの概略構成を示すブロック図。

【図２】図１に示す車車間通信システムにおける運転支援用カメラの車両に対する設置位置を示す斜視図。

【図３】センサおよび制御・通信処理用コンピュータを含むインフラ系設備が非設置の道路を走行する車両間の間接的な異常事象検出情報通信処理動作を説明するための図。

【図４】本実施形態に係る車車間通信システムの上記間接的異常事象検出情報通信処理に係る全体動作を説明するための概略フローチャート。

【図５】センサおよび制御・通信処理用コンピュータを含むインフラ系設備が非設置の道路を走行する車両間の間接的な異常事象検出情報通信処理動作を説明するための図。

【図６】センサおよび制御・通信処理用コンピュータを含むインフラ系設備が非設置の道路を走行する車両間の間接的な異常事象検出情報通信処理動作を説明するための図。

【図７】センサおよび制御・通信処理用コンピュータを含むインフラ系設備が非設置の道路を走行する車両間の直接的な異常事象検出情報通信処理動作を説明するための図。

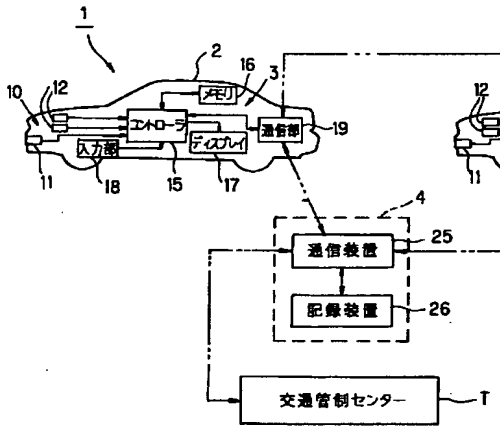
【図８】センサおよび制御・通信処理用コンピュータを含むインフラ系設備が非設置の道路を走行する車両間の直接的な交通状況検出情報通信処理動作を説明するための図。

【図９】（Ａ）は、直接的車車間通信の発展例として、後続車両に異常事象／交通状況検出情報を順次送信する動作を示す図、（Ｂ）は、直接的車車間通信の発展例として、異常事象／交通状況検出車両が無線通信可能範囲内の全ての車両に異常事象／交通状況検出情報を送信する動作を示す図、（Ｃ）は、直接的車車間通信の発展例として、異常事象／交通状況検出車両がすれ違う対向車両に対して異常事象／交通状況検出情報を送信する動作を示す図。

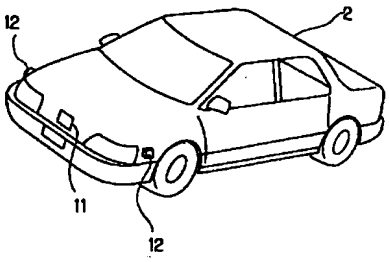
【符号の説明】

１　車車間通信システム
２、２ａ～２ｄ、２ｈ～２ｊ、２ｍ１～２ｍ３、２ｎ１～２ｎ３、２ｓｋ－２～２ｓｋ＋１、２ｔｋ－１～２ｔｋ＋１、２ｙ、２ｙｋ～２ｙｋ＋２、２ｘｋ、２ｘｋ＋１　車両
３　車車間ユニット
４　通信記録ユニット
１０　運転支援用カメラ
１１　前方障害物検出用カメラ
１２　側方障害物検出用カメラ
１５　コントローラ
１６　メモリ
１７　ディスプレイ
１８　入力部
１９　通信部
２５　通信装置
２６　記録装置
Ｔ　交通管制センター

【図１】

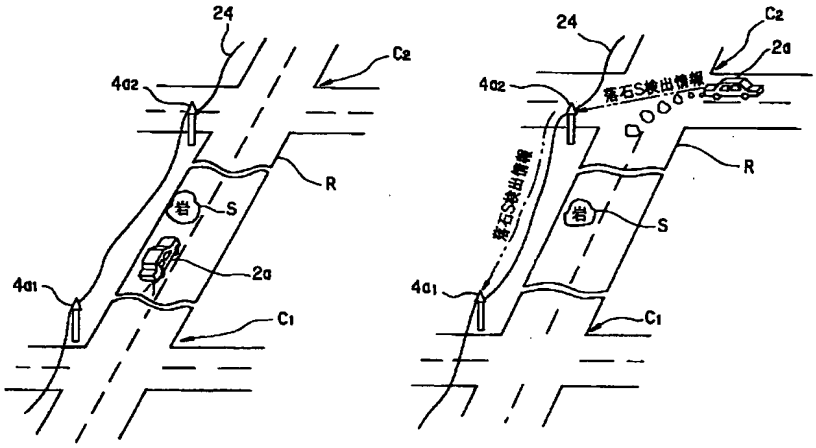

1
2
16
3
10
12
メモリ
コントローラ
ディスプレイ
通信部
19
入力部
11
18
15
17
4
通信装置
25
記録装置
26
交通管制センター
T

【図２】

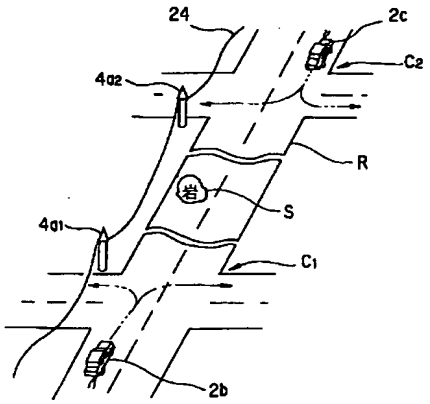

12
2
11
12

【図３】

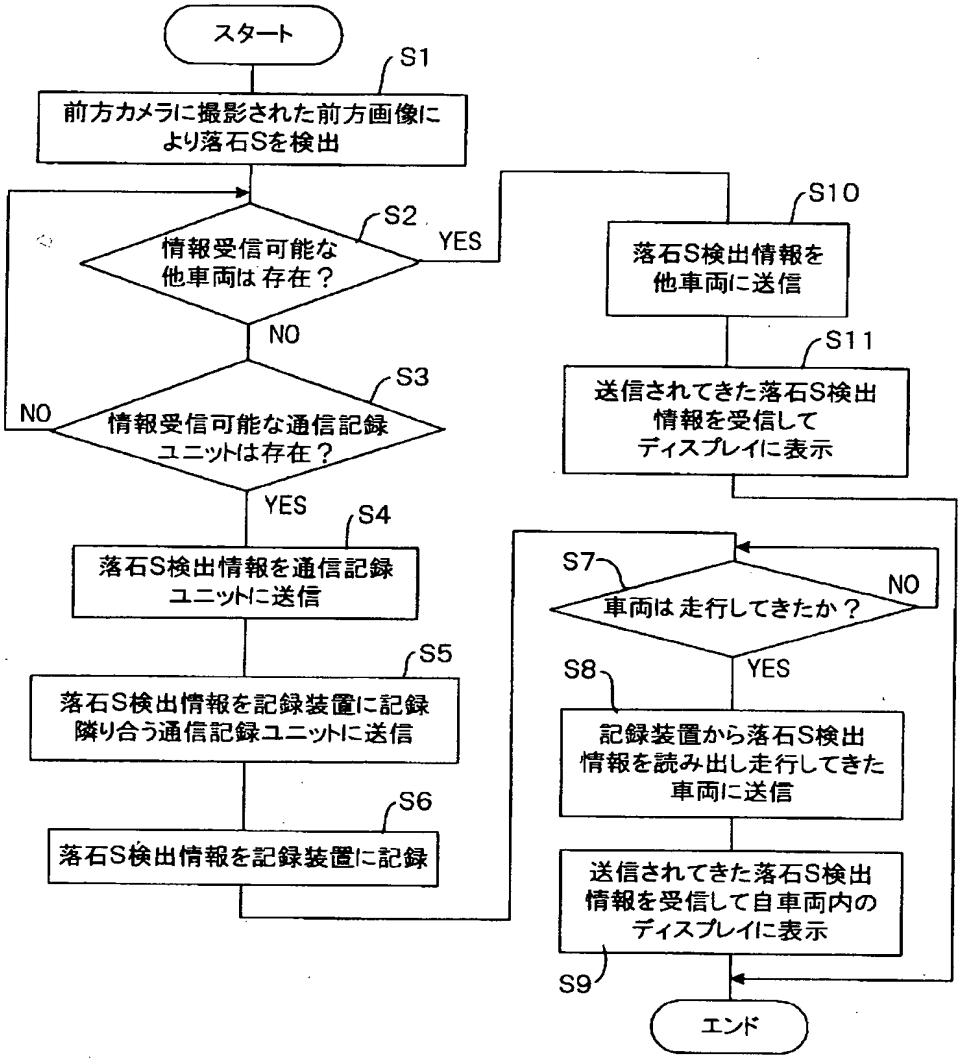
【図５】


24
C2
4a2
R
岩
S
2a
4a1
C1
落石S検出情報

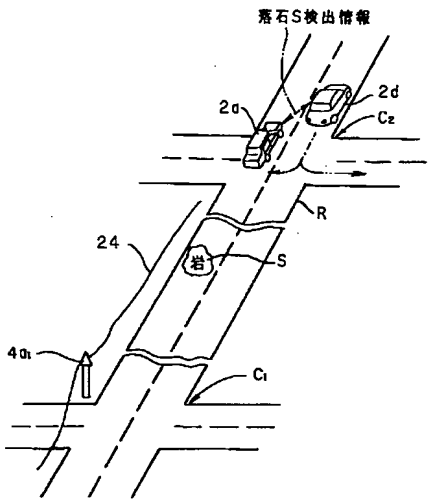
【図６】


24
2c
C2
4a2
R
岩
S
4a1
C1
2b

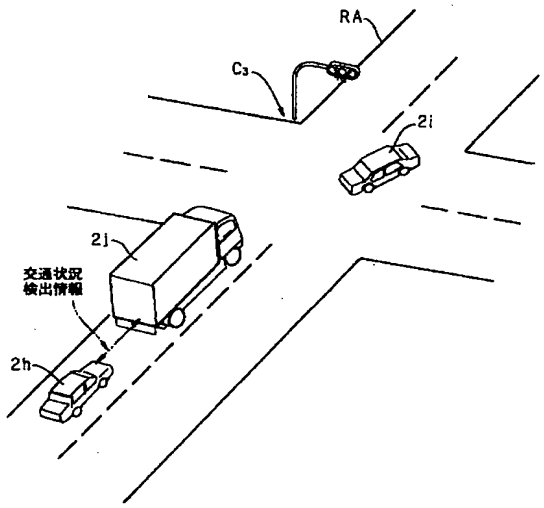
【図４】


スタート
S1
前方カメラに撮影された前方画像により落石Sを検出
S2
情報受信可能な他車両は存在？
YES
NO
S3
情報受信可能な通信記録ユニットは存在？
NO
YES
S4
落石S検出情報を通信記録ユニットに送信
S5
落石S検出情報を記録装置に記録隣り合う通信記録ユニットに送信
S6
落石S検出情報を記録装置に記録
S10
落石S検出情報を他車両に送信
S11
送信されてきた落石S検出情報を受信してディスプレイに表示
S7
車両は走行してきたか？
NO
YES
S8
記録装置から落石S検出情報を読み出し走行してきた車両に送信
送信されてきた落石S検出情報を受信して自車両内のディスプレイに表示
S9
エンド

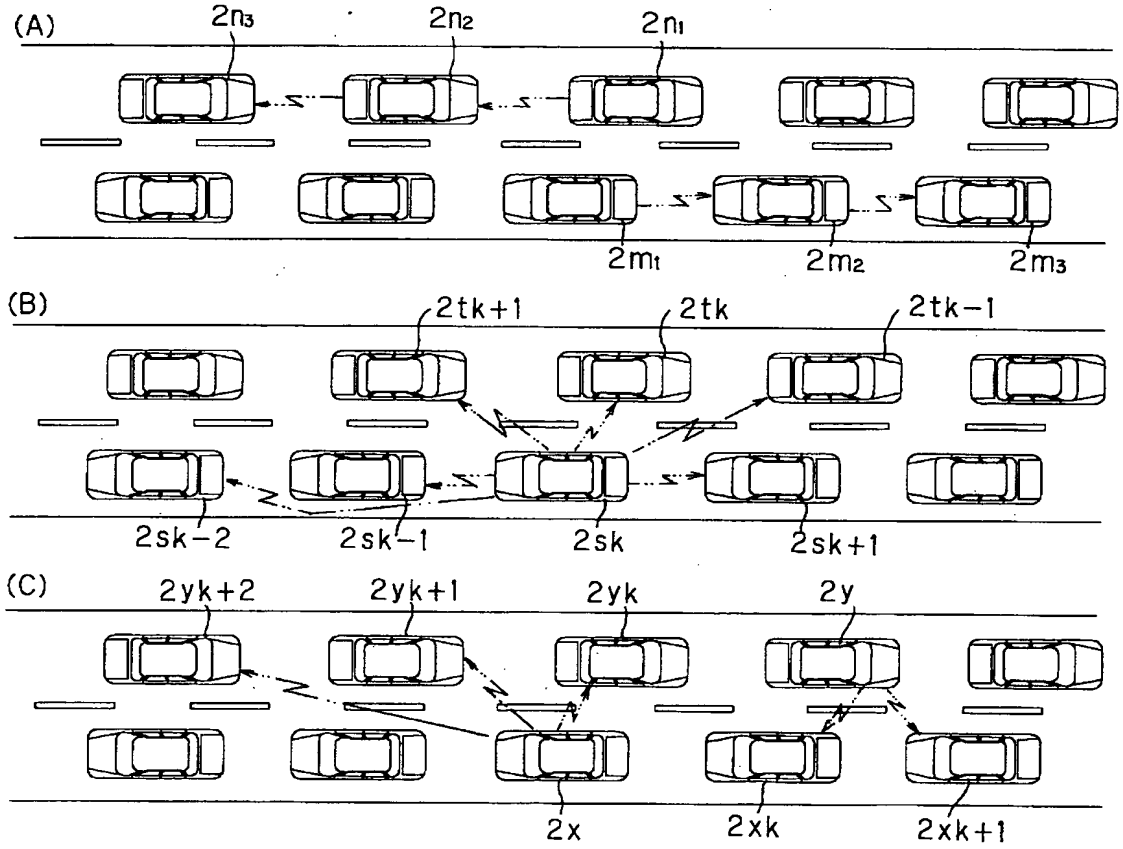
【図７】


落石S検出情報
2a
2d
C2
R
24
岩
S
4a1
C1

【図８】


RA
C3
2i
2j
交通状況
検出情報
2h

【図９】


(A)
2n3
2n2
2n1
2m1
2m2
2m3
(B)
2tk+1
2tk
2tk−1
2sk−2
2sk−1
2sk
2sk+1
(C)
2yk+2
2yk+1
2yk
2y
2x
2xk
2xk+1

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